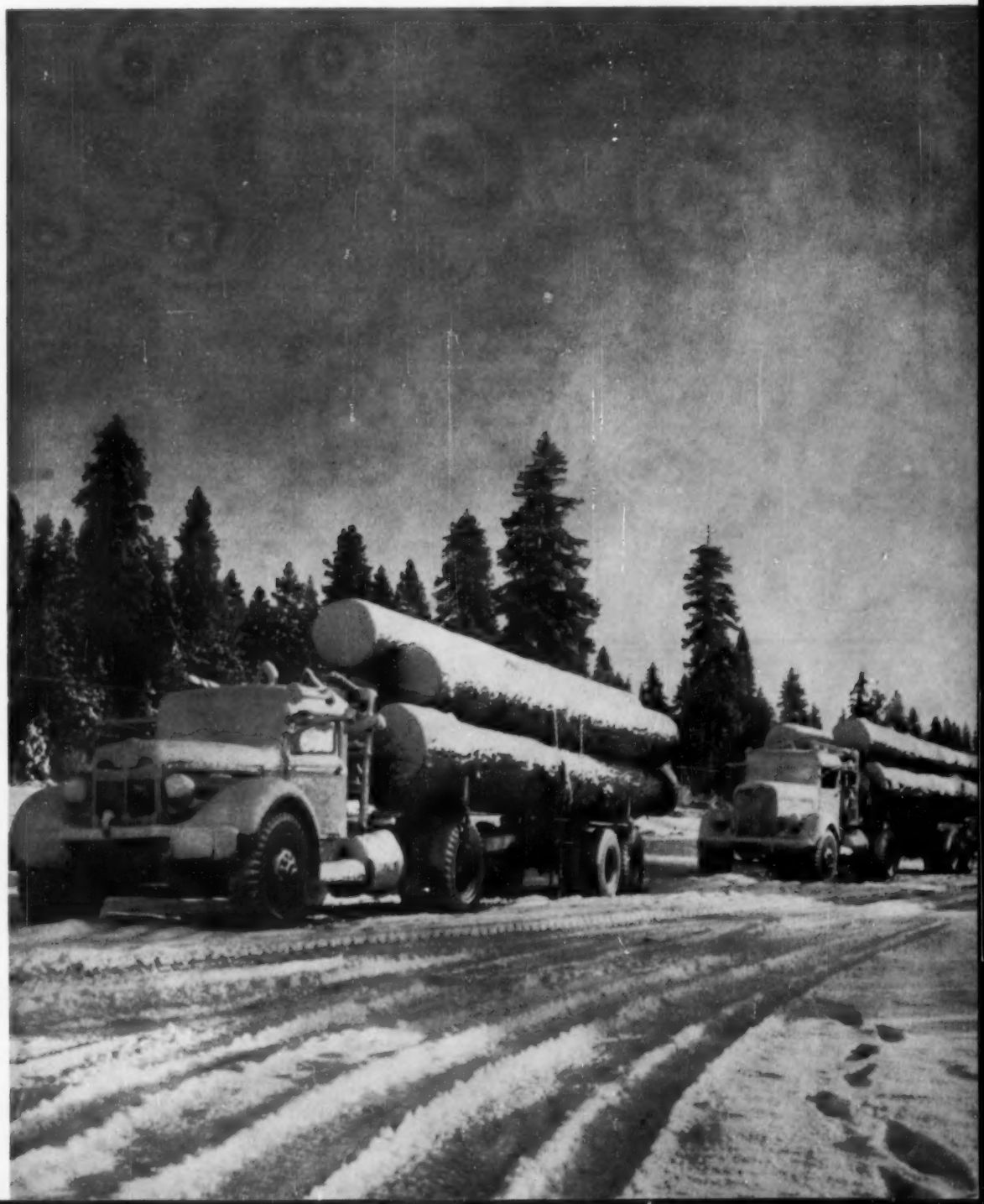
Journal of

FORESTRY

MARCH 1955



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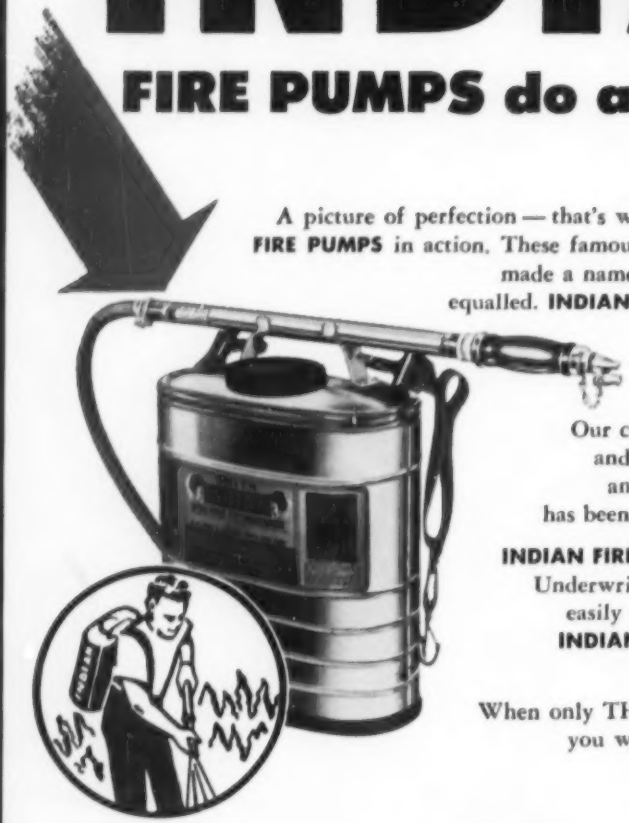

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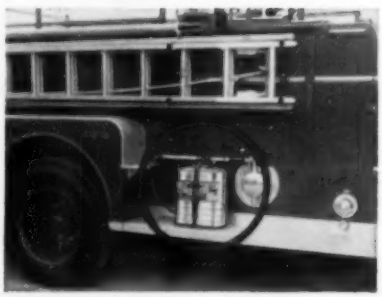

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Photo courtesy of Hammon, Jensen, and Wallen.

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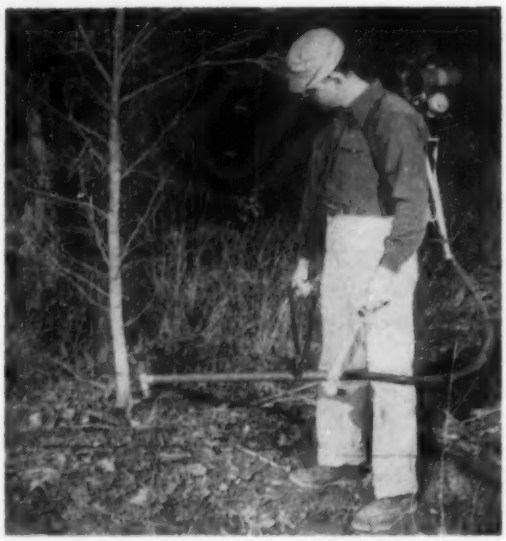

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A New Way to Look at Trees

David Bruce
Gulfcoast Research Center,
Southern Forest Experiment Station
Forest Service, U. S. Department of Agriculture

THE NEW LOOK—in timber cruising—is through a prism. The cruiser merely counts all the trees around a sampling point that are not cut in two when viewed through a wedge prism (Figs. 1, 2, 3). Multiplying the tree count by a predetermined factor gives the average basal area per acre around the sampling point. Timber volumes can be estimated if counted trees are recorded by merchantable height classes.

A prism—a thin wedge of glass that bends light rays—is a compact, convenient instrument for applying the point-sampling technique described by Grosenbaugh.[1] It is a substitute for the relascopes and other angle gauges[2] now used to establish reference angles in this new method of cruising.[3] A wedge prism about ¾ by 1½ inches in size is all that is needed on level ground or where slopes do not exceed 10 percent.

An unsteady hand gives little trouble, since the image of the tree remains still even though the prism moves. The eye is focussed on the tree alone, not on both the prism and the tree. It is necessary to check the alignment of only two lines. These three advantages obviate the major difficulties in using other relascopes: the failure of the eye to focus clearly on near and far points simultaneously, and the difficulty of aligning two reference points with two sides of the tree while the instrument is wobbling.

The distance of the prism from the eye may vary, the only limitation being that the prism be held over a fixed sampling point as the observer turns to check all trees around that point. The face of the prism should be at right angles to the line of sight, and on level ground the top edge should be horizontal. Deviations of 5 degrees in positioning the prism will cause no measurable errors, but greater inaccuracy may introduce notable bias.

Basal Area Factors

Wedge prisms can be obtained in any strengths useful in timber cruising. Prism strengths are measured in "prism diopters". One prism diopter is a right-angled deflection of one unit in one hundred units distance. Prism strengths of about 3 diopters are useful in small timber and in open stands, while

[1]Grosenbaugh, L. R. Plotless timber estimates—new, fast, easy. JOUR. FORESTRY 50:32-37. 1952.

[2]Bitterlich, W. Die Winkelzählprobe. Allgemeine Forst- und Holzwirtschaftliche Zeitung 59(1/2):4-5. 1948.

[3]In 1953, Mason, Bruce, and Girard, consulting foresters, Portland, Oregon, developed a device for establishing reference angles by a split image produced by two right-angled prisms used as mirrors. The prism instruments described here are modifications of this idea.

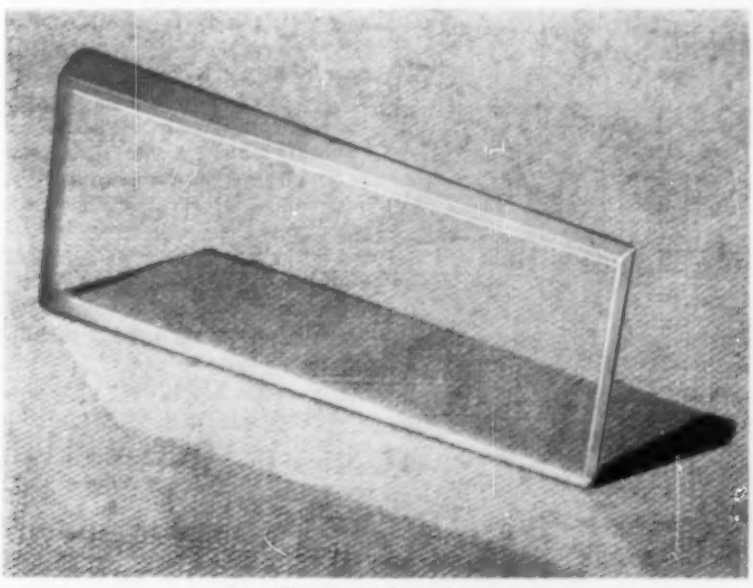

FIG. 1.—Wedge prism.

FIG. 2.—The prism shifts the image of the tree stem to one side.

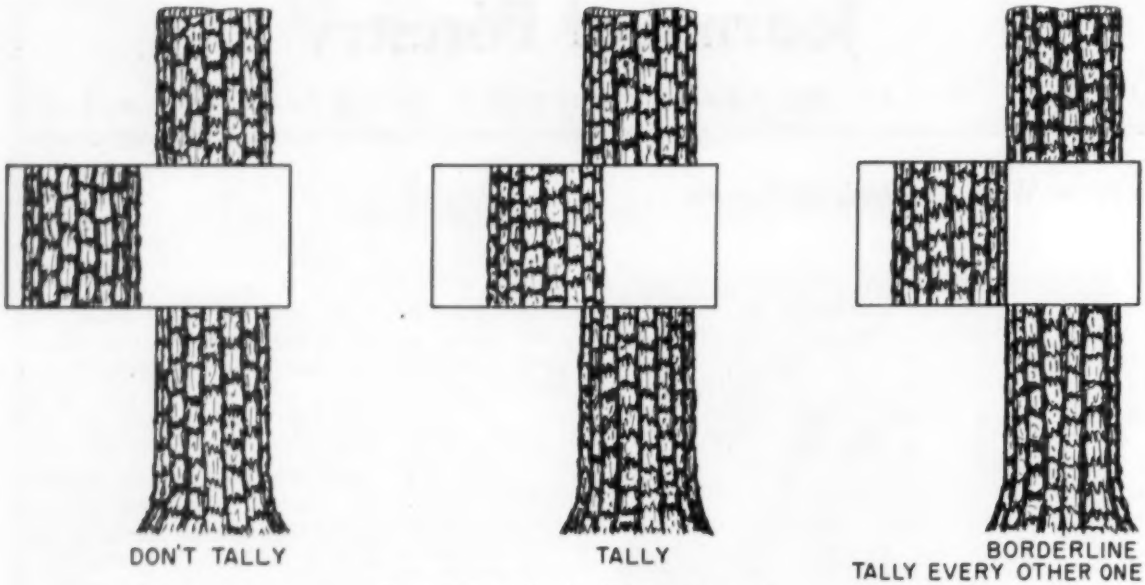

FIG. 3.—How to decide which trees to count.

stands with large timber or dense brush may require prisms as strong as 8 diopters.

Prism strength (diopters)	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Basal area factor	4.4	9.8	17.4	27.2	39.2	53.3	69.6

Prisms of spectacle quality can be purchased from manufacturers of optical parts for about a dollar apiece, cut and edged to sizes between 20 and 38 mm. (¾ and 1-½ inches). These inexpensive prisms are not manufactured to close tolerances. They may be as much as 0.1 diopter high or low. However, they may be used without modification if a basal area factor is computed for each prism. Specially manufactured prisms, with basal area factors of exactly 10, 20, 30, can be obtained at a much higher price. Also in the upper brackets are achromatic (color-corrected) prisms which eliminate the slight rainbow around the images seen through simple prisms.

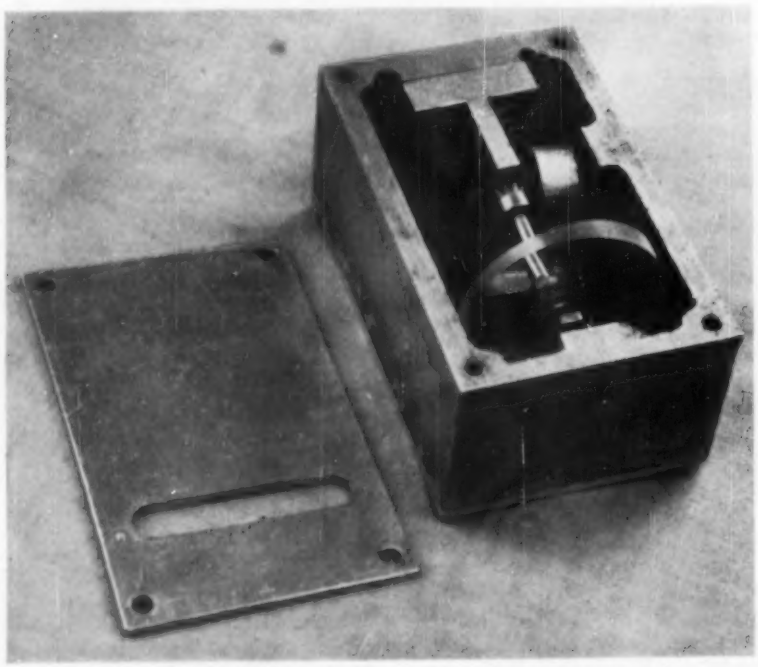

FIG. 4.—Automatic slope-adjusting instrument, top cover removed.

To determine the basal area factor of a prism, a rectangular target of some convenient width (1, 2, or 3 feet) is set up. Then a steel measuring tape is laid along the line perpendicular to the middle of the target. Next the prism is moved toward or away from the target over the line defined by the tape, until one side of the image of the target seen through the prism is exactly aligned with the other side of the target seen over the prism. The distance from the prism to the target is then measured accurately. With target width (w) and distance (d) both expressed in feet, the basal area factor for estimating square feet per acre is:

$$\frac{43{,}560}{1 + 4\left(\frac{d}{w}\right)^2}$$

A close approximation to this is:

$$10{,}890\left(\frac{w}{d}\right)^2$$

Slope Correction

Since horizontal acres are used in cruising, and since failure to correct for slopes of more than 10 percent will cause serious errors, some means of adjusting for slope is needed. To correct for slope, the prism is rotated around the line of sight by exactly the angle of inclination of the line of sight. Rotating the prism displaces the image vertically as well as horizontally. This reduces the horizontal angle to compensate exactly for slope distance. The vertical displacement of the image of a tree trunk gives no trouble in deciding whether or not to count the tree, but such displacement can be eliminated by using two equal (each half-power) prisms rotating in opposite directions. A prism used for slope-correction must have no vertical image-displacement when sighted on a horizontal line.

An automatic slope-adjusting instrument has been made (Fig. 4) in which a pendulum is linked by gears to the shaft on which the prism is mounted.[4] Round prisms like the one in this instrument make it easier to view trees on steep slopes. This instrument has fewer glass surfaces than an alternative design in which both the prism and the pendulum are mounted on a single horizontal shaft perpendicular to the line of sight. Such a design requires two mirrors mounted at 45° to the line of sight; the mirrors reduce light transmission and field of vision.

Telescopic Instruments

A wedge prism combined with a low-power telescope will increase the accuracy of decisions about borderline trees in open stands. In dense stands, this advantage may be lost if it becomes difficult to identify the two images of a given tree and if the telescope reduces image illumination.

An easy way to make a telescopic instrument is to mount a prism in front of the top or bottom half of the objective lens of a telescope (or one of the objectives of a pair of field glasses). This not only increases the accuracy of decisions, but also eliminates possible errors in holding the face of the prism at right angles to the line of sight.

Another inexpensive telescopic instrument can be made from a pair of two- or three-power Galilean (Dutch) binoculars having molded plastic lenses. The objective lens is sawed in two through the middle and the two halves decentered (shifted sideways along the cut edges). Then the overhanging edges are ground off and the lens is remounted in one half of the binoculars (Figs. 5 and 6).

A series of tests was made with two observers using the same instruments on well lighted targets. All instruments had basal area factors of about 10. Each observer made 10 estimates of the basal area factor of each instrument. Instruments were hand held, with no staffs or tripods to steady them.

The standard errors of the empirical basal area factors of the telescopic instruments, one plastic 3-power telescope and one prism with 6-power binoculars, were ± 0.03. For the simple prism and the stick-type relascope the standard errors were ± 0.06. The difference between observers in mean basal area factor was significant at

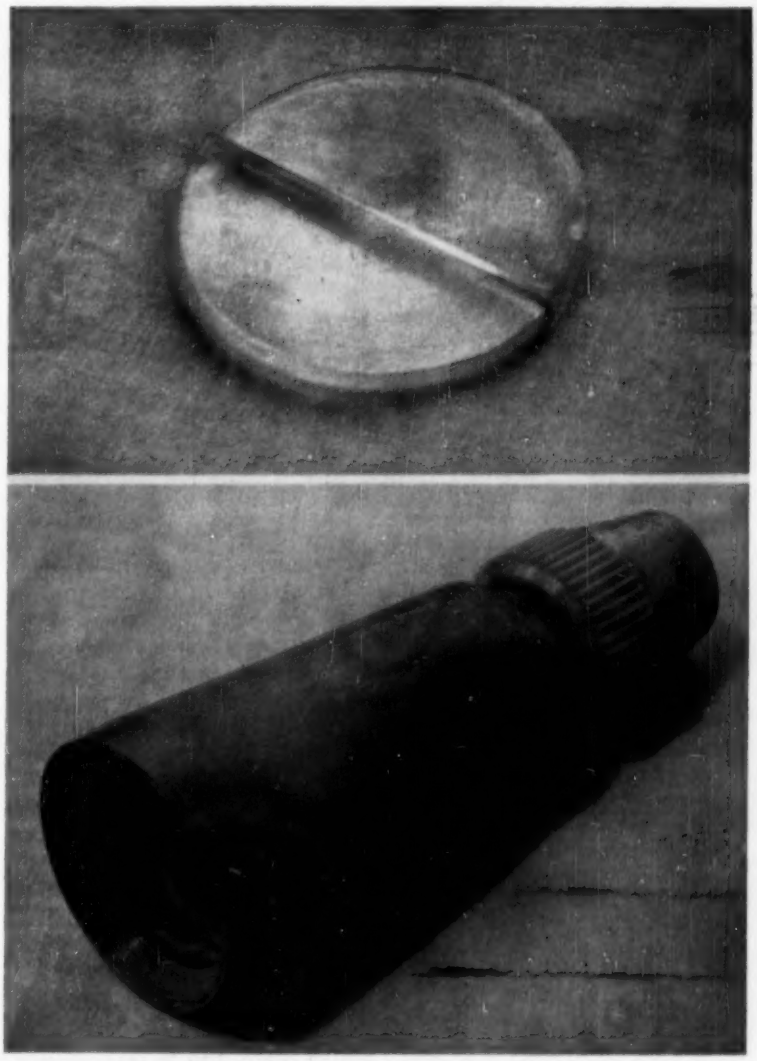

FIG. 5.—*Above:* Decentered plastic lens. *Below:* Telescope with decentered objective lens.

[4]The author gratefully acknowledges the assistance of Dr. L. B. Daron in cutting and edging prisms, and the painstaking work done by Mr. Ralph E. Lind in making and assembling the metal parts.

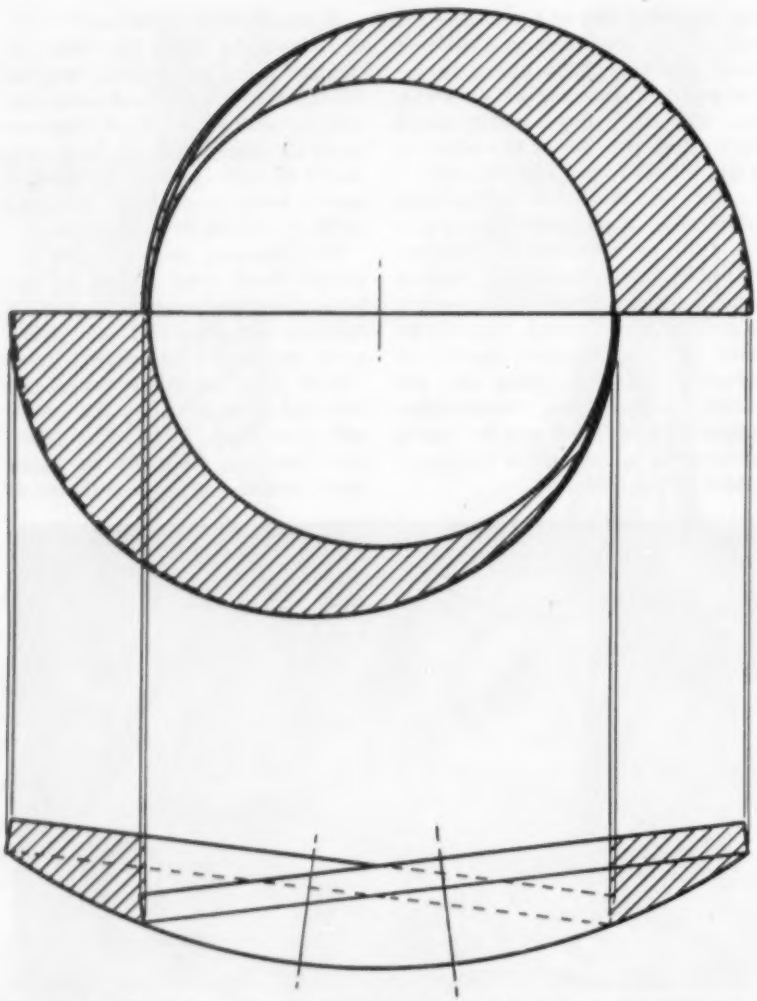

FIG. 6.—Halves of lenses shifted laterally (decentered) to produce prism effect. Crosshatched portions to be ground off.

the 1-percent level for the stick-type relascope, at the 5-percent level for the simple prism, and not significant for the two telescopic instruments. The outstanding advantages of the prism, as compared with the stick-type relascope, are its convenience and the ease and rapidity with which the decisions are made. These factors were not tested.

With telescopes the rainbows at the edges of images seen through simple prisms or decentered plastic lenses become objectionable. To improve the accuracy of decision about borderline trees, color-correction is needed. It can be achieved either by achromatic prisms or split achromatic lenses. For reasons of optical manufacture, the lenses might be the more economical alternative.

A telescopic instrument with automatic slope correction offers no great problems. Only the decentered objective lens need be rotated, and this could be done with a peripheral gear linked to a pendulum.

If an achromatic prism were used in front of an unaltered objective lens, slope correction would be achieved by the sort of arrangement shown in Figure 4.

Adjustable-Strength Prisms

To get rid of fractional basal area factors that increase the computing chore, and to make it easy to vary the basal area factor to suit the timber being cruised, adjustable-strength prisms may be used.

Two round wedge prisms of different power may be mounted on a single shaft. When they work together their combined power is the sum of their individual strengths. When one is rotated 180 degrees with respect to the other, the power is the difference of the individual strengths. All immediate strengths can be obtained by rotating less than 180 degrees. A 1.5 and a 4.0 diopter prism will give all basal area factors between 6.8 and 32.9. Index marks can be located on the edges of the prisms for factors of 10, 20, and 30.

Rectangular prisms with a precise basal area factor can be made by rotating, with respect to each other, two prisms whose combined strength is a little greater than that needed for the factor. The position producing the exact strength is marked on the prisms, which are then cut, edged, and cemented together. With targets exactly 1 foot wide, distances of 32.996, 23.329, 18.046, and 16.492 feet will give factors of 10, 20, 30, and 40.

Another way to make an adjustable prism is to use a positive lens and a negative lens that neutralize one another. Either spherical or cylindrical lenses will serve. If the lenses are placed in contact and decentered (i.e., moved sideways with respect to each other), they will form a wedge prism. The strength of this prism depends both on how far the lenses are decentered and on the strength of the lenses. The strength of a lens in diopters can be computed by dividing its focal length in millimeters into 1,000. Prism strength of decentered lenses can be calculated in prism diopters by multiplying the distance between centers in centimeters by lens strength in diopters. Prism diopters squared times 1.089 is the approximate basal area factor. The same formula may be used to estimate the amount of decentering of a split objective lens. With either the adjustable prism or the decentered lens, the final settings should be checked on a target before index marks are placed.

Adjustable prisms can also be used to correct for slope. A scale showing slope angles for one or two basal area factors can be placed on the prisms. Ocular estimates of slope will suffice for most trees. Slope measurement is needed only for an occasional close decision.

Using Prisms to Measure Distances

Instruments using the fixed reference angle principle can be used to establish distances (like the range finder in the Haga altimeter). If some distance is used often in plot work or in estimating tree heights, a target of suitable size can be set up and the observer can quickly locate points at the desired distance from the target. With a 3.00 diopter instrument, the opposite sides of an 18-inch target will be in line when the observer is 50 feet from the target. A 13.4-inch target at a plot center could be used with the same instrument to check borderline trees on a 1/10-acre plot more rapidly than a tape could be dragged around the plot.

To measure distances with an adjustable prism, a single target of convenient width may be used, with a scale of distances indexed on the prism.

❦❦❦

The New Indian Law and its Forestry Implications[1]

Glen A. Wilkinson, Esq.
Washington, D. C.

WITHIN two or three decades following establishment of our independence from Great Britain, started what we might term the westward evacuation of American Indians. This proceeded until some time following the Civil War, or until Congress dictated that Indian tribes should no longer be dealt with as dependent sovereign nations through the medium of treaties. Legislation outlawing further treaties with Indian Tribes was adopted in 1871.

In virtually all cases the treaties between the United States and Indian tribes provided for surrender of lands aboriginally occupied by the tribes in exchange for other areas of land westward of the areas occupied originally by the tribes. As this westward movement reached the Great Plains, the policy of concentrating Indians and Indian tribes on so-called Indian reservations was accelerated, partially at least, as a method of decreasing the military threat presented by many Indian tribes, particularly the Plains tribes.

The next important development in Indian administration came about in 1887 when Congress enacted the so-called General Allotment Act. This was preceded by a period during which persons involved in Indian administration decided that the way to cure the Indian problem was to civilize Indians—teach them the ways of the white man, with emphasis on agricultural pursuits. To implement this policy, the Allotment Act provided for the breaking up of Indian reservations by dividing the reservations into individual holdings of supposed economic size, and opening to settlement the balance of the reservation. The Indian holdings were to be in trust for a period of twenty-five years, after which the individual owners were to hold title in fee, and thus could deal with such holdings as any other landowners could do.

This policy was generally followed until the mid-1920's. The Hoover Commission report of 1949, consistently with other observations of people acquainted with the field, labeled this policy a total failure and concluded that its failure resulted from insufficient consideration of individual capabilities or of economic value of lands involved.

In 1934 Congress enacted the Indian Reorganization Act — an act which sought to preserve tribal identities, Indian cultures, and allow self-government by means of tribal corporations for those tribes which voluntarily accepted its terms. It is my considered opinion that this basic policy tended to retard assimilation by encouraging Indian citizens to remain on Indian reservations. It did, however, prohibit further allotment of tribal lands among the tribes accepting it.

Our government's Indian policy is again being reversed by the Withdrawal Acts of 1954. The 83rd Congress enacted and the President signed five withdrawal acts relating to the Menominee Tribe of Wisconsin, the Klamath Tribe of Oregon, a group of small tribes in Western Oregon, the Alabama and Coushatta Tribes of Texas, and four small groups of Southern Paiutes in Utah.

The remainder of this paper involves the resources and legal status of the Menominee and Klamath Reservations, the only reservations presently affected by withdrawal legislation which contain substantial timber resources. I confine myself to those two tribes for that reason.

The Menominee Reservation

The Menominee Reservation consists of approximately 234,000 acres, none of which has been allotted. Over 220,000 acres are covered by the Menominee forest, which includes hemlock, white and Norway pine, birch, oak, maple, and other species.

According to the latest figures, the Menominee forest has 1,340,000,000 board feet of timber still standing. Approximately 1,335,000,000 board feet have been cut

[1]The author, an attorney, presented this paper at a meeting of the Washington Section, Society of American Foresters, September 22, 1954.

since the reservation was established in 1854. A 1914 cruise showed 850,000,000 feet, and 750,000,000 feet have been cut since then.

The Menominee forest is operated under the sustained yield principle and these figures attest to the wisdom of such enlightened forest management. In reporting to the Congress on the withdrawal legislation early this year, the Secretary of the Interior had the following to say:

"The Menominee forest, in addition to representing the chief asset of the Menominee Tribe, is an important asset to Wisconsin and the United States as one of the outstanding forests in the country under sustained yield management."

In testyfying before the Joint Senate-House Indian Subcommittees on the same bill, the regional forester of the Bureau of Indian Affairs had this to say:

"The Menominee forest is one of the finest examples of the benefits derived from proper forest management."

The enlightened management of the Menominee forest is directly attributable to laws of Congress and modern forestry principles. In fact, as early as 1890 Congress passed a law authorizing the Secretary of the Interior to employ Indians to cut, transport, and sell logs to the highest bidder, but stipulated that no more than 20,000,000 board feet should be cut annually. In 1908 Congress passed another law authorizing construction of a sawmill, and again restricting the annual cut to 20,000,000 board feet of "fully matured and ripened green timber." This policy has been pursued to the present date.

The Klamath Reservation

The Klamath Reservation consists of approximately 1,100,000 acres, of which over 800,000 acres are forest lands (160,000 acres classified as noncommercial). The latest figures indicate approximately 3,843,000,000 board feet of tribal commercial timber still stands. Added to this are in excess of 300,000,000 board feet of commercial timber standing on individually owned allotments.

It is estimated that the reservation forest resources have an annual sustained yield capacity of approximately 60,000,000 board feet. During 1953, 59,000,000 board feet were sold for $1,927,000. A total of 4,630,000,000 board feet of timber has been cut on the reservation since 1913, when sustained yield cutting commenced. This has brought income to the Klamath Tribe in an amount approximating $31,500,000.

The Klamath forests contain predominantly ponderosa and sugar pine with some amounts of Douglas-fir, white fir, and lodgepole pine. The first cutting cycle is scheduled to be completed in 1959, and it is estimated that the second cycle (to run until 1999) will yield an annual cut of approximately 60,000,000 board feet.

Menominee Withdrawal Act

The Menominee Withdrawal Act became Public Law 399 of the 83rd Congress on June 17, 1954. It provides, in brief, that legal title, now held by the United States, will be vested in the Tribe, or in a commercial or cooperative corporation formed by it, on or before December 31, 1958.

This will mean that the Menominee lands will be subject to real property taxation and that governmental controls, such as those contained in the 1890 and 1908 acts, which have assured a continuation of the sustained yield policy, will no longer exist. To state it another way, the shareholders or the board of directors of the commercial or cooperative corporation to be formed will be able to determine, on or after January 1, 1959, whether the sustained yield principle of forestry management is to be followed or whether a portion or all of the reservation will be clearcut or sold as standing timber.

The Klamath Act achieves the same result but includes some peculiarities not present in the Menominee law. It provides that the Secretary of the Interior shall appoint a group of management specialists who are to carry out the following functions within four years from August 13, 1954:

1. Have a complete appraisal of Klamath property made.
2. Provide for an election by each adult member of the Klamath Tribe for himself and his children whether he elects to remain a member of the Tribe or accepts a 100 percent payment for his allocated portion of the tribal property determined by the appraisal.
3. Perfect and submit a plan for future management of the property.
4. Provide for release of restrictions on trust allotments and provide for issuance of fee patents to same.

Klamath Withdrawal Act

As in the case of the Menominee law, the Klamath law provides that legal title shall be transferred to the Klamath Tribe, or to an organization formed by it, on or before four years following enactment of the law—August 13, 1958. As with the Menominees, the Klamath property will then be subject to real property taxation and the remainder not sold for the purpose of paying the prorated shares to withdrawing members will be retained by the remaining members and operated through a commercial or cooperative corporation or other organization.

As is true with the Menominee forest, this will remove the check heretofore present by virtue of government supervision — supervision which has to date assured a continuation of management of the Klamath forest under the sustained yield principle.

Whether this is wise legislation, I find it difficult to say. I do wish some method could be found which would assure continued operation of the Menominee and Klamath forests on a program of sustained yield. This legislation does not, of course, provide any such assurance.

Production and Dissemination of Yellow-Poplar Seed

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A SERIES of studies was established in the Duke Forest between 1950 and 1953 to obtain information concerning the annual fall and dissemination of yellow-poplar seeds and their viability.[1] From these repeated observations data concerning the periodicity of good yellow-poplar seed years could be obtained which would prove valuable in planning future silvicultural operations. In addition, fruit-cluster counts for trees of various d.b.h. classes were made, and the average number of seeds per cluster was determined. From this combined information an indication can be obtained of the number of seed trees needed to restock cut-over stands.

In conjunction with this study an attempt was made to analyze the factors which determine the success or failure of restocking of cut-over areas with yellow-poplar, when an adequate seed source is present.

Description of Stand

The 25-acre area in which these studies were made was originally occupied by an unevenaged hardwood stand of the white oak—black oak—red oak type, with scattered yellow-poplar and shortleaf pine. Between 1945 and 1947 most of the mature and overmature trees were removed. However, yellow-poplar and some white oaks were left as a seed source to regenerate this stand. In 1950, when the first seed studies were made, an understory of yellow-poplar seedlings had become established throughout much of this tract, thus giving a two-storied appearance to the stand.

The residual stand on the study area contained an average of 19 yellow-poplar trees per acre between 4 and 27 inches d.b.h. and averaged 8 inches d.b.h. Only 12.6 percent of the 11 trees per acre between 4.0 and 6.5 inches d.b.h. bore fruit clusters, while all of the 2.3 trees per acre in the 9-inch and larger classes produced clusters.

Collection of Data

The 25-acre tract was divided into 1-acre blocks; in each were randomly placed two ¼-milacre seed traps. Thus a sample of 0.05 percent was made of each 1-acre block.

Each year the initial seed collection was near the first of November, and seed collections were made weekly until early March. At each collection the number of seeds was recorded per trap, and the percentage of viable seeds was determined by cutting tests.

In the autumn of 1952 the fruit clusters on yellow-poplar seed trees of various diameter classes were counted. In addition, the average number of seeds per cluster was determined from counts on 50 clusters.

Analysis of Data

Table 1 summarizes the results of the seed collections made from the autumn of 1950 through the winter of 1952-53.

The average percentage of viability for this 3-year period is 11.1.

The average number of seeds which fell per acre per year for 1950-51 and 1951-52 was between 300,000 and 400,000. The average number of seeds which fell per acre for the 1952-53 season was over 500,000. The higher figure for 1952-53 was probably caused by the fact that seed collection was started ten days earlier than in the two previous years.

TABLE 1.—SUMMARY OF RESULTS OF SEED COLLECTIONS

Year	Total number of seeds collected	Number of viable seeds collected	Percentage of viability
1950-51	4,476	454	10.1
1951-52	4,669	566	12.1
1952-53	6,498	725	11.2

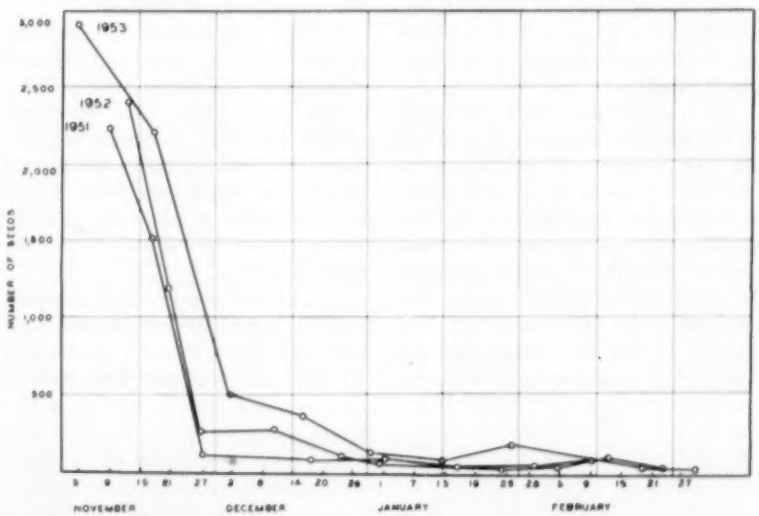

FIG. 1.—Total number of yellow-poplar seeds collected at two week intervals for three successive years.

[1]The following former students in the Duke School of Forestry participated in one or more phases of the studies herein reported: Louis W. Powell, David V. Smith, Robert E. Breadon, Barry F. Malac, and Francis G. Davis.

The results of three years' seed collection are shown in Figure 1. Yellow-poplar seed fall reaches a maximum during the first two weeks of November. Although not shown by Figure 1, seed fall really begins in mid-October and some seed continues to fall until late March.

Analyses were made of the relationship between certain climatic factors and the total number of seeds collected. Seed fall was found to be high during periods of high temperature and also during periods of low rainfall. This might indicate that relative humidity would have some effect; however, the data showed no relationship.

The number of fruit clusters on trees of various diameter classes was obtained with the aid of binoculars. From these data a graph was constructed which shows the relationship between d.b.h. and number of clusters for trees between 8 and 20 inches d.b.h. (Fig. 2).

In addition, the number of seeds per fruit cluster was obtained for 50 clusters selected at random from the experimental area. The average number of seeds per cluster was 80.8. By multiplying the viability percentage by the average number of seeds per cluster, an estimate of the number of viable seeds per cluster was obtained. When these values are inserted along the right hand axis of Figure 2, the relationship between d.b.h. and the number of viable seeds produced per tree is obtained.

To test the relative significance of competition, seed supply and soil on the number of yellow-poplar seedlings located in specific areas, a regression was derived by the method of least squares. The number and distribution of yellow-poplar seed trees over the study area and especially the amount of seed caught in the seed traps indicate that, on the portions of the area

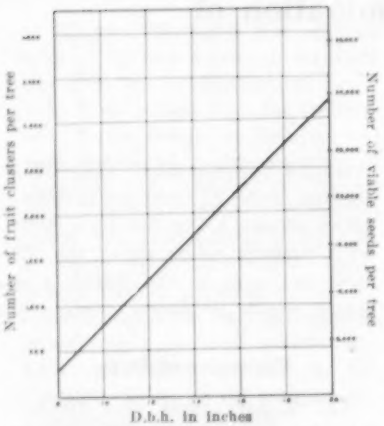

FIG. 2.—The relation between diameter breast height and the number of fruit clusters is shown on the left hand axis, and the relation between diameter breast height and the number of viable seeds is shown on the right hand axis.

lacking adequate reproduction of yellow-poplar, its failure is the result of factors other than seed supply. Likewise the soil factors—depth of the A_1 and B horizons and texture—were sufficiently favorable to seed germination and seedling establishment so that they too were not significant in causing failure of natural reproduction.

Summary

A series of studies was made in the Duke Forest to obtain information on the distribution and viability of yellow-poplar seed. After three years of study the following conclusions were drawn.

1. An abundance of yellow-poplar seed is produced almost every year. Although poor yellow-poplar seed years have been reported in some localities of the East, they are probably the result of weather conditions unfavorable for pollination at the time of flowering, rather than a failure to produce flowers.

2. Yellow-poplar seed dissemination begins in mid-October and reaches its peak in early November. By the end of November yellow-poplar seed fall is drastically reduced, but some seeds continue to fall throughout the winter.

3. Yellow-poplar seed fall of 300,000 or more seeds per acre is not uncommon in those areas where several seed trees per acre are present.

4. The average viability of yellow-poplar seed for a 3-year period, as indicated by cutting tests, was 11.1 percent. This value is similar to figures obtained by other workers in different sections of the country. Viable seed falls from mid-October to the middle of March. Seed which is shed late in the winter has the same percentage of viability as seed shed early in the autumn.

5. A relationship was established between d.b.h. and the number of fruit clusters per tree (Fig. 2).

6. The average number of yellow-poplar seeds per fruit cluster, obtained by actual count, was 80.8.

7. Seed dissemination was high during periods of high temperature and also during periods of low rainfall. High seed fall occurred during dry periods and seed dissemination was very low following weeks of heavy rain.

8. The number of yellow-poplar seedlings becoming established was greatest where little or no litter was present on the soil surface and in openings free of tree and shrub competition.

9. If environmental conditions are reasonably favorable for the germination and establishment of yellow-poplar seedlings, 8 to 10 yellow-poplar seed trees (14 to 20 inches d.b.h.) per acre should provide adequate seed for reproducing cut-over stands. Regardless of the number of seed trees left, areas with heavy accumulations of raw humus, poor soil aeration, or severe competition by residual woody vegetation will not regenerate to yellow-poplar.

Use of Graded Nursery Stock for Red Pine Plantations

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In two studies of red pine plantations on the Allegheny Plateau of Pennsylvania, large seedlings were found to have an advantage in growth rate over smaller planting stock; and they still held this advantage after 12 years. Two different planting methods tried resulted in only slight differences in survival, growth, and frost-heaving.

RED PINE (*Pinus resinosa*) has long been one of the most popular species for reforestation work in the Northeast. It has been preferred over other species because of its excellent form, its rapid height and diameter growth, and its relative freedom from insect and disease attacks when planted on suitable sites.

For proper development, red pine requires a severe winter climate and a well-drained and fairly acid soil. It grows naturally in the Northeast only on well-drained acid soils in places where the average temperature of the winter months is below 25°F. and where a drop to —10° is common (*4*). In Pennsylvania such conditions are found in the north-central and northwestern parts of the state.

During the 1930's extensive planting operations were carried out on the Allegheny National Forest by the Civilian Conservation Corps, using red pine as one of the principal species. In connection with this planting, a series of test plantations was established by the Allegheny Forest Experiment Station[1] in an effort to answer a number of questions that arose.

Size of Stock and Survival

One study was made to determine (1) the relative ability of different sizes of planting stock to survive in bracken fern, and (2) the growth behavior of such planting stock.

The planting stock used was 2-1 red pine grown from Maine seed. It was graded into three size classes: small, medium, and large (Table 1). It was planted at a spacing of 6 feet by 6 feet.

[1]Now the Northeastern Forest Experiment Station.

The planting site was level. Seventy-five percent or more of the ground was covered heavily with bracken fern (*Pteris aquilina* L.); other ground vegetation was grass, yarrow, goldenrod, and small aspen suckers (Fig. 1). The soil was a clay loam.

Survival was good despite the competition (Table 2) and differences among the size classes of planting stock were not significant for survival. But the size classes did have a significant effect on early leader growth. At 12 years the differences in diameter and height growth were highly significant (Table 3).

TABLE 1.—SPECIFICATIONS FOR SIZE OF GRADED 2–1 RED PINE PLANTING STOCK

Size class	Length of top		Stem diameter		Length of root		Average weight
	Average	Range	Average	Range	Average	Range	
	Inches						*Grams*
Small	2.75	2–3.5	0.11	0.8–.13	6.5	4–10	7.29
Medium	4.25	3.5–5	.16	.13–.19	8.0	5–12	13.90
Large	6.00	5–7	.22	.22–.28	9.0	7–13	33.40

TABLE 2.—SURVIVAL AND INITIAL GROWTH OF RED PINE PLANTED IN BRACKEN FERN COMPETITION

Size class	Survival[1]				Leader growth, first season
	First fall	Second fall	5 years	12 years	
	Percent				*Inches*
Small	96.5	91.5	89.0	64	0.92
Medium	98.0	93.0	88.5	64	1.40
Large	95.0	91.0	85.0	69	1.78

[1]The western half of one of the two plantations died almost completely between the 5- and 12-year examinations. The cause is not known, but may have been either a fire or some soil condition. This is the reason for the drop in survival of all size classes at 12 years. This part of the plantation was not included in calculations of mean heights and diameters.

Planting Methods

Another study was made to determine how size of planting stock affected (1) early losses from frost-heaving and (2) later growth and development of the trees.

Again 2-1 red pine from Maine seed was used, graded as small, medium, and large. The planting site was an open field, level, with a stiff clay soil that was very subject to frost-heaving. An earlier plantation on this site had failed because of frost-heaving.

Two planting methods were tried: center hole and modified mound. In the center-hole method, the planter digs a small hole, places the seedling in the center, and packs earth in all around the root system.

In the mound method, the planter digs a rectangular hole and makes a wedge-shaped mound of earth in the center. He divides the root system of the seedling, placing half on one side of the mound and half on the other, and then packs earth in around the roots.

During the first winter, losses from frost-heaving averaged 9 percent. Losses were significantly

TABLE 3.—MEAN DIAMETER AND HEIGHT OF RED PINE PLANTINGS AT 12 YEARS

Size class	D.b.h.	Height
	Inches	*Feet*
Small	1.53	9.8
Medium	1.85	10.2
Large	2.25	12.0

FIG. 1.—One of the experimental planting sites on the Allegheny National Forest. The dense cover of bracken fern, just leafing out here, did not offer serious competition to the red pine seedlings.

FIG. 2.—The same site shown in Figure 1, 12 years later, with red pine successfully established. Large planting stock had an early growth advantage over smaller stock, and at 12 years was still growing better.

TABLE 4.—FROST-HEAVING OF RED PINE PLANTINGS DURING FIRST WINTER

Planting method	Small stock	Medium stock	Large stock
	Percent		
Center-hole	7	5	4
Mound	18	10	9

TABLE 5.—GROWTH AND SURVIVAL OF RED PINE PLANTINGS AT 12 YEARS (BOTH PLANTING METHODS)

Size class	Mean d.b.h.	Mean height	Survival
	Inches	*Feet*	*Percent*
Small	2.3	12.5	76
Medium	2.9	14.2	88
Large	3.5	14.9	90

greater where the mound planting method was used (Table 4). Size of stock also had a significant effect on frost-heaving losses.

Twelve years after planting, the average survival of these plantings was 84 percent, for both planting methods and all stock sizes (Table 5). The planting methods made no significant difference in either survival or growth, but the size of stock still had an effect on growth.

Discussion

Bracken fern apparently does not offer serious competition to 2-1 red pine stock (*1*) as survival was excellent for all size classes in spite of a heavy cover of it. Causes of mortality were studied at the 6-month and 1-year examinations, and little was found due to competition. The most common cause of death was browsing by deer, and this was not serious.

Marked differences in growth were found among the three size classes of planting stock. The better growth of the large stock appeared with the first season's growth, and the difference continued throughout the 12-year period of observation. It is not clear to what extent the continuing differences in size are due to the slower starting of the smaller stock, and to what extent they are due to inherent differences in growth rate and vigor (which may be expected to continue throughout the life of the tree).

This initial growth advantage of larger stock has been reported by other investigators. Fowells (*2*),

working with ponderosa and Jeffrey pines, found similar differences continuing at least 9 years after planting. Pomeroy (*5*), working with 1-0 jack pine, found marked initial differences in height growth, but at the end of 13 years these were becoming less pronounced.

Hough (*3*), using 2-1 red pine graded on a weight basis, found that the larger seedlings not only grew faster initially, but at the end of 10 years had increased their growth rate in comparison to that of the medium and small stock.

It does not necessarily follow that these differences would continue throughout the life of the tree, particularly in a plantation composed of a single class of stock. It does seem probable that in a planting containing a mixture of all size classes, the majority of the dominants would be from the larger planting stock; since, if a tree is well ahead at the time competition develops in the plantation, it is likely to stay ahead.

In the study of planting methods and frost-heaving, total losses from frost-heaving were light. Since an earlier plantation on this site failed completely, the difference must be attributed to milder weather conditions during the winters of 1938-39 and 1939-40. Had conditions been as severe as they evidently were during the first years after the earlier plantation was established, there might have been a much greater difference in losses between the two planting methods.

As might have been expected, the loss from frost-heaving was slightly less with the larger seedlings, which had stronger and deeper root systems. Loss was somewhat greater for the mound method of planting. With this method the root system is apt to be slightly nearer the surface, and may therefore be more susceptible to frost-heaving.

These results differ from findings of similar studies in the Lake States. Studies there showed that first-year survival was poorer for small stock (*7*). This may be because the planting stock used in the Pennsylvania plantations was somewhat larger, and was 2-1 stock (2-0 stock was used in the Lake States). Also, the site conditions in Pennsylvania were less severe than might be expected in the Lake States.

A Lake States study on plantation failures (*6*) showed that cramped root systems resulting from slit-planting brought about greater mortality and poorer height growth than well-distributed root systems. Thus it was thought that the mound method might give better survival and growth in the Pennsylvania studies. It did not.

Recommendations

Since the mound method of planting was somewhat more expensive than the center-hole method, gave slightly greater losses from frost-heaving, and gave similar results in survival and growth, the center-hole method seems preferable.

Use of the larger planting stock slightly reduced loss from frost-heaving. However, it seems unlikely that the difference would be important on any but the most severe sites.

In view of the limited ability of red pine to express dominance and the consequent need of early thinning in plantations, it would seem that the presence of some slower-growing trees in a well-stocked plantation would be beneficial. It would encourage early differentiation of crown classes and would delay the need for the first thinning.

Therefore there seems to be no justification for the additional expense of grading red pine 2-1 planting stock as a general practice—at least within the limits of the specifications used in this study and under conditions where good survival may reasonably be expected.

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Some Practical Aspects of Range Management on the National Forests[1]

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THE VEGETATIVE TYPES in the Southwest vary with elevation from the semidesert grass type with a heavy invasion of mesquite brush and cholla cactus beginning at about 2,400 feet through dense chaparral pinon pine, and juniper woodland to large stands of virgin and cutover ponderosa pine at 7,000 feet and above. In the higher mountains above the pine type are small areas of aspen and some larger areas of dense spruce and fir. In this higher elevation are scattered open bunchgrass areas. In general, natural watering places for livestock are very inadequate. A large percentage of the area is not readily accessible to livestock use because of steep slopes, distance to water, dense stands of spruce, fir timber, and pine reproduction. In the grassland areas associated with the woodland type, invasion of juniper and pinon is seriously competing with the natural forage.

The Carson and Santa Fe National Forests are situated in the southern part of the Rocky Mountains in northern New Mexico. Due to high elevations and severe winters, the grazing on these two forests is almost entirely limited to summer use. Because of the mild winters in the greater part of the remainder of the region, much of the grazing use is year-long. Many people coming to the Southwest for the first time are surprised at the vast semidesert areas of low grazing capacity that are grazed by livestock.

Ordinarily, the months of May and June are dry. Summer rains come in July, August, and September. These three months constitute the principal growing season, during which time most of the grass forage must be produced for grazing during the entire twelve months. The browse species and a few early spring grasses make their growth from winter moisture.

History of Grazing Use

Some livestock have grazed intermittently in the Southwest since 1540 when Coronado sought the seven cities of Cibola, taking with him 1,000 horses, 500 cattle, and 5,000 sheep. The period of continuous grazing began about 1700. Missions established in Texas, New Mexico, and Arizona between 1670 and 1690 became livestock centers soon after 1700.[2] The first intensive grazing use was by large companies in the late 1870's or early 1880's. They were formed by men with money to invest who were attracted by the large profits to be made in the livestock business. Big herds were trailed in from Texas, Oklahoma, and Kansas. With the building of railroads, a wider market was provided for the sale of livestock. More cattle were shipped in and grazing use of the range became intensive; for example, in 1884 the Aztec Land and Cattle Company, more popularly known as the "Hash Knife Outfit," turned loose 28,000 head of cattle at Holbrook, Arizona. Overgrazing was the inevitable result. Ranges that for permanent and regular use would have been overstocked with one cow to every 100 acres were loaded until they were carrying one cow to every ten acres. Gradually, the native grasses were depleted.[3]

Starvation of cattle followed the severe droughts in 1893 and 1894. Thousands of cattle died. The big boom collapsed and many large outfits went bankrupt. In the early 1890's sheepmen began to gain a foothold on the ranges.[3] Large sheep herds were brought in during early spring and summer and grazed across the same ranges being used by cattle. Inevitable conflict between the two kinds of livestock resulted, and bitter range wars between the two interests followed. These resulted not only in the loss of many livestock, but also in human lives.

The depletion of the good native grasses through overgrazing resulted in sheet and gully erosion. Much of the thin layer of top soil was lost and with it the ability of the range lands to produce the maximum amount of forage.

With the establishment of the national forests and government control, a degree of order and stability to the livestock industry was begun. Definite allotment of areas for grazing specified numbers of livestock was made. Gradually, one by one, these were fenced and redivided by fences.

At the present time, sheep and cattle are separated and, except in a few cases, common use is not practiced. In northern New Mexico there are large community allotments with as many as 80 to 90 permittees on each. In much of the region, however, each permittee has an individual fenced allotment. On a few allotments from 2 to 12 permittees use the area in common as a community allotment. This allocation of range areas with the fixed responsibility of the individual permittee or small group of permittees has made possible the application of good on-the-ground management practices.

Size of the Problem

On the National Forests in Arizona and New Mexico there are 1,210 cattle and horse allotments, 115 sheep allotments, and 36 common use allotments, containing a little over 19 million acres of government-owned land. In 1952, 216,900 cattle and horses and 179,800 sheep were permitted to graze on

[1] Paper presented at the annual meeting, Society of American Foresters, Colorado Springs, Colo., September, 1953.

[2] The Western Range, Senate Document 199, 1936.

[3] Barnes, Will C. Western grazing grounds and forest ranges. Breedle's Gazette. 1913.

these allotments.[4] The on-the-ground personnel for administering these areas consist of 71 rangers and 25 assistant rangers. Each district ranger is responsible for an average of 268,000 acres.

The Present Status of Management

The degree and kind of management being practiced in this arid region varies allotment by allotment and ranch by ranch. The range condition and management needed to produce the maximum in meat and wool on a longtime basis are in need of betterment on many ranges. There is no range in the Southwest that should be grazed continuously without rest if it is to produce its maximum in forage. Material progress has and is being made. The reasons why progress in management is slow and the constructive approach that can be taken to get the job done will be discussed.

Technical and Social Aspects of the Problem

The major technical problems are:

1. Generally thin shallow soils which, accompanied by an arid fluctuating climate, result in a relatively slow range recovery potential. Range recovery varies from 5 to 10 years in the very best sites where depletion of forage and soil is not advanced, to 100 years, and longer where forage and soil are badly depleted. Management in the Southwest must be planned on the expectancy of reoccurring drought years.

2. Large areas of rough, inadequately watered range.

3. Poor condition of much of the more accessible range areas. Invasion by noxious plants, which have replaced much of the better native forage.

4. Lack of early spring feed, resulting in too early grazing of high mountain ranges.

5. A three-months' growing season during July, August, and September in which the grass forage for the entire twelve months must be produced. There is a usual drought period in May and June.

6. Yearlong grazing of the range without any deferment of use.

The social and economic problems are:

1. A much greater demand for range than can be met.

2. Large communities in northern New Mexico with insufficient commensurate ranch property to maintain their livestock during the early spring, late fall, and winter.

3. Financial inability of many of the permittees in small communities to help themselves and install necessary range improvements.

4. In northern New Mexico the large number of permittees on one allotment, each having only a small number of livestock, extremely complicates management. The only solution through which progress has been made is by working through their associations.

5. A heavy investment in ranches in other parts of the region which requires a definite annual return to meet current financial obligations.

6. Old traditions in the use of the range as a yearlong breeding ground and in management practices.

7. Division of range areas into allotments which are not always logical management units.

8. Grazing by unauthorized livestock. Much of the past damage from overgrazing has been by nonpermitted livestock. This problem has been largely met, but it is much more difficult to control numbers on yearlong ranges than on those used on a seasonal basis.

Objectives

The broad over-all objectives in the management and use of the national forest range in the Southwest are no different from those in any other part of the country and briefly are as follows:

1. Obtain the maximum sustained forage use from each acre of usable range land.

2. Stabilize the soil—the basic range resource.

3. Increase the forage production of range lands that are producing less than they should.

4. Properly and efficiently utilize forage available for livestock.

These objectives can be accomplished by the application of sound logical principles in range improvement and management practices.

Range Improvement.—1. Revegetation of adaptable sites to increase forage production and provide early spring forage. Thus far, 33,000 acres have been planted on a project basis. Research tests in northern New Mexico have shown that these revegetated areas will produce from five to ten times as much forage as adjacent native ranges. In feeding tests on one area, poor cows in the spring for a 30-day period made an average gain of over four pounds per day on an area planted to created wheatgrass. Comparable cows grazed during the same period on adjoining native range made an average gain of one pound per day. Revegetation is not a magical cure-all, but will greatly help in meeting the major objectives on many areas.

2. Noxious plant control. Large areas of grasslands in the Southwest have been invaded by such noxious plants as juniper, sagebrush and mesquite brush. It has been demonstrated that effective control of juniper and sagebrush can be obtained by mechanical means on a practical basis with a consequent improvement in range condition. In Arizona 20,000 acres of juniper which had invaded natural grasslands were cleared by mechanical means at a cost of $2-$4 per acre. Approximately one million acres in the region should be cleared. Sagebrush has been controlled on several thousand acres by mechanical means, in connection with reseeding. Research has made material progress in determining how to control mesquite by chemical spraying.

3. Prescribed Burning. There is probably a place for prescribed burning in the Southwest to improve range conditions. More research is needed to determine how it can be effectively used.

4. Construction of needed range

[4] U. S. Forest Service, Region 3. 1932 Annual Grazing Report.

improvements. Some 14,000 miles of control fence and 4,000 water developments have been constructed on the National Forests in the Southwest since the days of the open range. An additional 5,000 miles of fence and 2,500 water developments are needed if the maximum use is to be obtained from these wild lands. Even more may be indicated as the management of the grazing use becomes more and more intensive.

Management Practices. — 1. A good inventory and classification of the range resource. Range reconnaissance surveys have been made through the years on all of the National-Forest lands. These are being supplanted by individual allotment analyses, including condition and trend surveys of the range areas as a basis for management.

2. Deferred and Rotation Grazing. Much of the Southwestern ranges are used yearlong by breeding herds. It has been proven that the harmful effects of continuous yearlong grazing can be neutralized by a sound plan of deferred and rotation grazing. This means that many allotments would have to be divided by fences into management units. Small allotments where division is not feasible can be combined with other small allotments for management purposes. There are some fine examples of deferred and rotation grazing in the Southwest but unfortunately it is practiced to a limited extent only.

3. Seasonal Use. If maximum forage production is to be obtained, each range must be used during the season for which it is best suited. Studies of range readiness are necessary to determine the proper season of use.

4. Adjustments in present numbers and seasons. Other things being equal, good management practices will make a difference of at least 25 per cent in the grazing capacity of a range as compared to a similar range without management. It will not, however, solve all the problems on some badly overstocked ranges or where they are not grazed during the proper grazing season. In these cases some adjustments in numbers and seasons are necessary.

The Federal Land Administrator in Range Management

Range management is a relatively young science. Much has been learned about the technical aspects of it during the past forty years—and much more remains to be learned through research. The technical knowledge of range management already available is not being put to wide use and the technical knowledge is considerably in advance of getting good management on the ground.

The federal land administrator is not a dictator. He is a public servant, working for the best interests of all the people. No matter how wide his experience, how good his judgment, or how thorough his technical knowledge of range management, he cannot arbitrarily prepare a plan of management for a range unit, present it to the operator, and tell him how he is going to conduct this operation.

The federal administrator must be a good judge and analyzer of range conditions. He should be able to point out the sore spots and conditions in need of correction without specifying the details of just what has to be done.

Effective on-the-ground management on public lands can be obtained only through working with the livestockman who has the privilege of grazing the lands and obtaining his active cooperation. The details of management must be worked out through discussion with the operator. Adequate time should be taken to sit on the corral fence and "whittle" with him. The operator must realize that good management is of more profit and benefit to him than to anyone else. His ideas should be used insofar as they protect the public lands, will correct the sore spots, and provide good management. Any plan of management not worked out in cooperation with the permittee on the ground is not worth the time and effort spent on it.

This requires well trained administrators who are not only well founded in scientific range management but have an understanding of the stockman's problems and are also adept in dealing with people. Good methods of education and extension are needed to break down some of the old range traditions and established methods of handling ranges and livestock which have been proven faulty.

Precept and example are not sufficient for there are still many examples of poor management just across the fence from a profitable operation being well managed. A gradual but steady trend toward better management is taking place as, one by one, ranch managers realize the need for a reserve supply of forage in this unpredictable arid climate and the additional profit to be made by intensive management of the land.

Any range management plan for federal lands should be based upon the following concepts in order to be effective:

1. Must be worked out with the operator on the ground.
2. Must be practical, fairly simple, and technically sound.
3. Must be flexible to meet changing conditions.
4. Must be followed up to see how it is working out.
5. Must be tailor made to fit the particular area and the rancher's operations.

Interpretation as a Means of Developing Responsibility for the Care of Public Lands[1]

Edwin C. Alberts
Park naturalist, Rocky Mountain National Park, Colorado

THE WORD "interpretation" has many uses. The dictionaries generally agree that it means the explanation of what is obscure, or the translation into familiar terms or language of unfamiliar words or understandings. In National Park Service work the word connotes more than this. Interpretation has been said ". . . not only to supply the factual material, but also to arouse in the park visitor a consciousness of the vast forces of Nature constantly at work, to have him recognize the adaptability of life forms. . . ." Man's function and interest in this complex matter is usually keyed in whenever possible. We may define *interpretation* as a process of developing an understanding and an appreciation of natural features to the layman, and where he fits into the story.

The phrase "care of Public Lands" is a fairly obvious one. *Public lands* are clearly those lands being administered by various federal or state land management agencies. Their *care*, however, might well be subject to some dispute. For the purpose of this paper we must assume that proper "care of public lands" is defined as enlightened management to achieve those purposes for which the lands were set aside, or were withheld from private entry. In the national parks, this care is the preservation of the natural scene, so far as this is consistent with public recreational use. In the national forests, this care involves prudent exploitation of the varied resources of the areas, free of waste and subject to an overall plan. In a wildlife refuge, I suppose, the proper care of the area is that which promotes the safety and development of such wildlife species as are in danger.

One more part of our title needs some clarification, too. "Public responsibility" means many things to many people. It varies with current political thought. In my experience it is susceptible to two subdivisions, at least. One is the immediate avoidance, by all of us as good citizens, of doing direct harm to public or private lands. We don't, for example, leave burning campfires, litter the roadside, commit arson, nor shoot at directional signs. We hope all other citizens also practice such self-discipline. Certainly, if everyone did so, many land management problems would be eased. Much of this is merely learning good manners; much of it is universally recognized as current civic virtue.

There is another phase to our "public responsibility", which is to realize the obvious necessity of conserving our dwindling resources. If crime runs rampant in our communities, we rise in indignation and drive out the rascals. It possibly damages our civilization more if range-lands wash into our reservoirs than if slot-machines creep into our grocery stores. But seldom do we have the motivation to protest against the former activities — especially since preventive measures cost money. Developing public responsibility for our public lands probably includes the alerting of people to dangers to the resources which these lands conserve.

What we are thinking about here is not "indoctrination", but rather *interpretation*—the development of an understanding and an appreciation of features of the lands which we manage, and of the ways in which man's welfare is associated with them. If, after inspecting our work and understanding the objectives we are trying to carry out in his behalf, John Q. Taxpayer becomes imbued with a spark of that zeal which keeps us all in this conservation business, we properly feel a sense of accomplishment. He has acquired some of this second and more subtle sense of public responsibility.

So, we have defined our terms, and made some inferences as to

FIG. 1.—A group of national park visitors on a guided field trip attentively listen to an interpretative talk by their guide ". . . not only to supply the factual material, but also to arouse in the park visitor a consciousness of the vast forces of Nature constantly at work, to have him recognize the adaptibility of life forms. . . ."

[1]Paper presented at the annual meeting, Society of American Foresters, Colorado Springs, Colo., September, 1953.

their use in this field. Through interpretation of the significance of various land management units it appears possible to arouse some public interest in, and develop some citizen responsibility for the care of these areas, first by a stimulation of self-discipline by the visitor to the area to prevent vandalism and other direct damage, and secondly by arousing civic interest in the maintenance of these areas for the purpose for which they were established.

The writer has been engaged in work of this sort with the National Park Service for some eighteen years but feels that he is still, in a sense, feeling his way. The National Park Service has been providing interpretation since the 1920's, but is still experimenting in some ways, and is conscious of many lapses and inadequacies, most of which are due to shortage of funds. We have many parks and monument areas of great potentialities completely unmanned and undeveloped in an interpretive way.

Nevertheless, the words "National Park" evoke a mental image, to many people, of a friendly, uniformed "ranger"—a stereotype of a well-informed nature guide who leads a party of hikers to some sparkling mountain lake, opening their minds to new feelings of man's place in nature. Our emphasis has always been upon "in situ" interpretation—field trips in the parks or exhibits at, or near, features of significance. This on-site interpretation is accomplished by a variety of methods, and through use of various devices. An example of park interpretive work is that engaged in at the Rocky Mountain National Park. It is not an elaborate program; our budget is relatively small; our personnel put in many uncompensated overtime hours in order that the numerous commitments for talks or field trips may be honored; most of our exhibits are either home-made or have been rehabilitated locally.

Perhaps the most effective type of field interpretation is provided by the guided field trips. During the visitor season we schedule daily naturalist-conducted hikes to points of interest. Parties up to 50 people can be accommodated on such trips; we have had a few unwieldy parties of a hundred; in Carlsbad Caverns National Park we have had parties of over 2,000 persons. These latter groups are admittedly not interpretive tours, of course. In Rocky Mountain National Park we have a few naturalist-conducted horseback trips; these permit longer trips, with a considerable degree of interpretation. Boat trips of an interpretive nature have been tried out on the new reservoirs of Granby and Shadow Mountain. They have proved astonishingly popular. Short "Nature" walks are scheduled frequently. They serve the needs of many people who, for lack of time, or because of physical infirmities, can't take the longer hikes. Auto caravans were formerly a popular means of field-trip interpretation. We have had to abandon nearly all of them at Rocky Mountain because of the traffic problem they engender. In some areas—one thinks of Death Valley National Monument—they will always be the major means of field interpretation.

Illustrated talks are given at various outlets in and near the park, usually in the evenings. We provide forty-five minute talks, always illustrated with slides or movies, each evening at the park museum. Each program covers one of the main "chapters" in the park story. At the hotels we provide broader scope talks, usually on the lighter side. We give informal programs at the campgrounds, often with group singing. Some programs of this nature are scheduled without visual aids; specimens may be passed around—rocks, or a beaver paw, for example. At all these evening programs efforts are made to develop one or two major understandings of the park's significance. We seldom hesitate to discuss various operational problems if they tie into the major understanding we are trying to achieve.

Self-guiding nature trails are one supplement to limited available personnel time for conducted trips. We've only made a start in this field at Rocky Mountain; some park areas have fine systems of such interpretive devices. Automatic recorded talks are another answer to manpower shortages. At Moraine Museum in Rocky Mountain National Park we have had excellent results with a fifteen-minute recorded talk about the glaciated landscape visible from the porch of this structure. Roadside exhibits, locally produced, help orient the visitor at the several parking areas on our park roads. Although taking much precious time to fabricate, they serve a 14-hour-a-day shift without further cost. We have had very little vandalism trouble with these structures. Of course, park visitors are less likely to commit vandalism than casual motorists along a main highway. Colorful, eye-catching exhibits in the main museum, or our branch exhibit-room at Fall River Pass, help get the "park story" across to the hurried visitor. In none of these exhibits do we deliberately suggest, say, the undesirable nature of littering the road with our picnic refuse, or the peril some park areas may find themselves in because of some potential menace. The exhibits merely tell the story; once the significance of the area is visualized, the visitor usually feels somewhat convinced of the desirability of continued management of the area as a National Park.

Indeed, the objective of the National Park Service interpretive program is roughly as follows:

1. Understanding the area through interpretation.
2. Appreciation of its values through understanding it.
3. Protection of the park through this appreciation.

These objectives are usually achieved quite incidentally—perhaps inadvertently—for few of us have enough time with the visitor to give him the "whole course," even though we should, perhaps, like to do so. Our program usually relates the facts of natural history as seen by the visitors, or described by the exhibits, to his park experience. This occurs almost automatically because the visitor is on the spot; he gets these new ideas or

understandings while hiking the trails in the park, while breathing its air, and viewing its scenery. This is much more effective, then, than the use of sound-films, or providing an extension talk to a school group, desirable though these techniques may be. The place to "sell" these conservation policies is in the field.

National Park interpretation inevitably gives an assist to other conservation agencies and their work. Park forests, for example, are not used for timber, but are rather preserved as living natural exhibits. They are used for recreation, for inspiration, and for scientific studies of relatively undisturbed natural landscapes. In order to show that our society can afford to save a few specimens of such unexploited park forests, we must show that we need never have a timber famine if we properly administer and exploit the timber of national forests. The watershed protection values of many national parks is a collateral value which, when discussed, leads to an exposition of the necessity of soil erosion prevention elsewhere. The development of a sympathetic understanding of the values of the national parks interlocks with a similar attitude to other types of conservation and sound land management.

Success of this "protection through interpretation" is hard to measure. It is not like some innovation in a department store, where the change in sales receipts evaluates the effort quite accurately. It is likely that were these interpretive efforts abandoned in the national parks, an immediate increase in vandalism and related problems would be noted. Such a statement is difficult to prove, or disprove, of course. With us, in the National Park Service, interpretation has become as traditional as the submission of a monthly report. To many of our park visitors, interpretive services are as essential to their enjoyment as are paved roads.

Certainly, the writer is convinced that even very dilute doses of interpretation worked at Carlsbad Caverns, where he was stationed at one time. It is still with some amazement that he recalls taking a group of some 800 persons through the cave one busy day, with only a lady guide to help him. Without this group having been given what must have been a rather stimulating orientation talk, the stalactites along the trail would surely have evaporated. Interpretation undoubtedly helps in archeological areas; even the crudest vandals are less likely to carve their initials in a timber which they have learned was cut with a stone axe eight hundred years ago. Certainly a very convincing case can be built up to show that interpretation *does* definitely help develop public responsibility for our park lands, insofar as the first immediate self-policing motivation by visitors is concerned.

Possibly, an equally convincing case could be worked up to show that, through exposure to park interpretation, a large segment of our population have had their thinking refurbished regarding the vague "conservation is good" principle, and have developed new ideas of the place of man in his natural environment, with consequent concern about the wasteful exploitation of products of his natural environment. If this is true, the benefits to all conservation work are considerable, and out of all proportion to the small budget for such work and the small area of the public domain which is managed by the National Park Service.

Of course, this work hasn't spared us some continuing attacks upon the integrity of our own park lands. Hetch Hetchy reservoir, in Yosemite National Park, was built; this, however, was before there was any effective park interpretive work or well developed public support for rigid preservation of park values; in fact before there was a National Park Service. The Adams Tunnel of the Bureau of Reclamation passes right through the Rocky Mountain National Park—well under the park, it should be mentioned—but few of us can call this a loss of any obvious tangible park values. You will ask, "What about Dinosaur National Monument?" Certainly this is no test of our thesis here, for scarcely anyone has had any "on-site" interpretation of the canyons portion of that area. Better tests would consider places which we have interpreted. It is extremely unlikely that any proposals to utilize the hydrothermal waters of Yellowstone's geysers for a steam laundry, or to quarry limestone on the rim of the Grand Canyon, would succeed. These areas have been interpreted to perhaps millions of persons for nearly a quarter of a century. They are now a part of every American's heritage. Perhaps they would have been in any case, but it is obvious that interpretation has greatly helped make them so much a part of any western traveler's experience.

The key to successful interpretation, if we are to measure its achievements by this broad-gauge development of public responsibility, seems to lie in the identification of people with the scene and with the world of nature. It is best achieved by developing realizations of man's dependence upon the natural environment, while he is in contact with it. It is problematical to what extent organizations other than national or state parks may utilize these techniques.

Many possible applications occur to one, of course. Guided tours are not unusual in many organizational units, although they are more apt to be "show-me days" for local public relations benefits, than to show the average touring citizen how he has invested his taxes. It would seem possible, in some instances at least, to schedule a "show-me month" during the visitor season. These activities are really an obligation to the public, but are often lost sight of. True, the costs are somewhat high, and must be expected to go on and on, year after year, once they are begun.

On-site lectures are also possible at areas where personnel are stationed anyway. One thinks of some of the heavily visited Forest Service campgrounds, or perhaps the headquarters of a wildlife refuge, in this connection. Talks of this sort require no graduate in public speaking; anyone with competent

knowledge of his subject, and with sincerity, can make an effective talk to the average visitor.

On-site exhibits can be visualized at many places in the public lands where they do not exist today. Campgrounds are a logical site for short self-guiding nature trails, or for an interpretive panel at the bulletin board. Scenic viewpoints on highways traversing public lands are obvious sites for "What-You-See" panels. Our own roadside panels of this sort are cheap—perhaps $50 will cover each panel. They may look cheap, but they help send away satisfied visitors. Larger signs, similar to the historical markers in Montana or New Mexico, could interpret interesting public land features. One problem of preserving these public lands for the public lies in the fact that most of the public don't know the lands are their property. Merely telling that fact might help conserve them. True, these things cost money and require planning. Few activities which we can engage in, however, give any more direct benefit to so many citizens.

Summary

Our present Western culture and way-of-life are utterly dependent upon utilization of natural resources. If this way-of-life is to continue—if our species is to survive—utilization of lands, soil, forests and other resources *must* be intelligently programmed. This is dependent upon continued public support, and public cooperation.

Although many nature-lovers give this support almost blindly and intuitively, many citizens react only to the so-called pocket-book nerve. Development of this enlightened self-interest requires many methods. One technique which we have found to be successful in the development of public responsibility for the national parks is interpretation of the significance of these lands, and of man's relationship to them and to the natural environment of which the lands are a part.

Not only is interpretation valuable as an adjunct to a progressive public relations and education program, but it is in a sense our obligation to other members of the society in which we live. Possibilities for application of these interpretive techniques exist in many federal land management units, in addition to those areas managed by the National Park Service, where interpretation is a traditional activity.

Wildlife Management in Relation to Multiple Use[1]

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AN ANALYSIS of the historical stages of game management, and of the progress from one stage to another, reveals the reluctance of the public to accept new ideas. One finds that ordinarily each progressive step is hampered by deep impressions in the minds of people of those ideas that fit a previous need, but may no longer apply. Such measures as the "Buck law," large areas of inviolate refuge, artificial feeding, artificial propagation, and extermination of predators may be cited.

The Gunnison Area

The Gunnison area in Colorado will be used as an example of this type of public reaction. In so doing, no criticism of the Colorado Game and Fish Department is intended. That agency is progressive, well staffed, and capably administered. Its efforts toward sound, up-to-date management are commendable. The Department has furnished much of the historical record used herein and is in general agreement with statements herein made concerning the Gunnison deer herd. It is, however, faced with the difficult problem of counteracting obsolete ideas in the face of changing conditions.

The Gunnison area was for many years famous for its deer hunting. Under the buck law, and with large game refuges and extensive predator control, the herd increased from an estimated 300 in 1910 to over 30,000 in 1950. Somewhere in that period—probably in the early 1930's—the sustained capacity of the range was passed. Ridges, once shrub-covered, that constituted the critical deer wintering grounds are now bare. Deer die-offs occurred during the winters of 1933-34, 1939-40, 1947-48, and 1951-52, but those and the hunting season removals were insufficient to change the downward trend in range condition and carrying capacity. Likewise, until recent years at least, they reduced the deer herd only temporarily.

From 1910 to 1912 the hunting of buck deer was legal. The season was closed entirely from 1913 to 1918, and then opened again to antlered deer hunting. From 1941 to 1944 limited anterless deer licensees were sold. Then, for eight years, one deer of either sex was legal. And now, in 1953, local pressure has resulted in another "bucks only" season, contrary to the judgment of the biologists concerned with game and range management.

Aggressive predator control began about 40 years ago with effective campaigns by the Forest Service against wolves. Since 1915 the Fish and Wildlife Service (formerly Biological Survey) hunted coyotes for the benefit of livestock and game. The sportsmen, through their license fees, contribute toward organized predator control, and in addition finance a state bounty on mountain lions, notwith-

[1]Paper presented at the annual meeting, Society of American Foresters, Colorado Springs, Colo., September, 1953.

standing a twenty-year overpopulation of deer.

Artificial feeding of deer was started at least 20 years ago and has been practiced intermittently (under the influence of local public pressure) until just a few years ago. And, within the past few months, there has been effort by a well-intentioned scientific group to create a large game refuge within the problem area. Current effort is upon artificial restoration of the range—a commendable activity if the pressure of grazing animals is light enough to allow for seedling plant survival.

A sober analysis today reveals a depleted range, the basic soil resource gone in places, the deer herd facing ultimate paucity. Management has been more strongly influenced by local public pressure than by ecological requirements. Despite the educational efforts of game and range managers, public sentiment still reflects the obsolete ideas of game protection. The Gunnison is typical of some other ranges in various stages of decadence elsewhere in the Rocky Mountain region. Fortunately, delay in public support for progressive management has had less damaging effect over much of Colorado and other western states.

Current Emphasis

The purpose of this introduction is to stimulate thinking about current emphasis on wildlife management. Are we expounding ideas today that may soon be contrary to the needs of management? Are we laying pitfalls for our successors in the field of forest wildlife management? If we can forecast inevitable changing conditions, we should be planning now to meet them.

Two broad statements have been made so frequently as to be accepted without the qualification they deserve. One is that good forestry (or good land management) is good for wildlife. If that is so, what is the explanation for exceptionally productive game population on land that has been mismanaged by standards now deemed acceptable? Some of the best deer ranges have developed as successional stages following over-cutting of timber, over-grazing of livestock, or uncontrolled fire.

It is not the purpose of this paper to advocate mismanagement of any resource. Neither is it implied that good management for one resource is necessarily bad for another. Rather, it is a question of how good for one is how good for another.

For example, if the objective of the forester is to produce the maximum of quality wood products from a forest unit, he would not want many open parks or burns for long periods. His natural inclination would be to quickly start commercial tree reproduction of optimum density. Yet important game species require openings and edges.

Aspen, which covers extensive burned-over areas, is a tree of limited commercial importance in this region. Yet the aspen type is highly important to wildlife. Its unique herbaceous understory provides favored forage for big game; it is the main support of beavers whose ponds greatly improve the fishing in small streams; and most important, through its extensive root system, aspen aids in the healing of gullies and the protection of stream banks from erosion. It might be good timber management to hasten the complete conversion of aspen toward a coniferous climax, but it would not be good for wildlife.

Watershed studies indicate that water yields may be materially influenced by changing vegetative cover types. Eradication of woody riparian vegetation, and the conversion of relatively deep-rooted aspen stands to bunchgrasses, have been proposed to increase streamflow. Both can be accomplished over a period of years by selective livestock grazing. Either can be detrimental to fish and game—aspen conversion for the reasons given above; riparian shrubs from the standpoint of fish stream environment. So it is not always true that good watershed management, if directed toward maximum production of "usable" water, is good for wildlife.

Similarly, the manager of a cattle range would be more interested in a grass cover than in shrubs for winter deer forage (unless the browse were used for livestock). And the land manager might not be disturbed at loss from sheep grazing of browse on winter game ranges if an adequate cover remained to prevent erosion.

It seems evident then that the best for timber, or the best for livestock, or the best for water, are not the best—and possibly not even good—for wildlife.

The second statement commonly accepted is that wildlife must be a by-product of some other major land use. On privately owned land, that is usually true. But in the Rocky Mountain region, forest and "wildland" are largely in public ownership. About 50 percent of the area of Colorado west of the plains is administered by the Forest Service or the Bureau of Land Management. The range so administered supports about two-thirds of the deer and nearly all of the elk within the state. It provides much of the area open to public hunting and fishing. How these lands are managed determines to a considerable extent the future of big game hunting in the state. The 100,000 and more big game hunters who use these public lands in Colorado might question whether there are not critical areas within the National Forests and the federal Ranges where wildlife deserves dominant recognition.

Need for Planning

In an economy of surplus natural resources, incentives for maximum production of one crop exert minor influences upon another. But, as demand approaches or exceeds supply, the likelihood of conflict in usage arises. The multiple-use policies of the federal land management agencies become more difficult to apply. That added pressures are complicating the management of forests and wildlands is indicated by the consideration foresters are now giving to land-use

priority plans. These plans are a recognition that under intensive use some conflicts will develop. While serious conflicts are usually limited to relatively small areas, priorities must be established. Thus the designation of important recreation areas may restrict, or even eliminate, commercial timber exploitation in small portions of a forest unit. And so the requirements of wildlife may justify the designation of areas where other uses will be so restricted as to assure that critical wildlife needs are not impaired.

On the National Forests of Colorado, it is estimated that something less than 10 percent of the area furnishes winter range for deer, but winter range is the limiting factor for the deer herds. If deer are to be supported in quantity, winter range must be provided. Elsewhere on the forests coordination with other major uses will ordinarily suffice. So long as winter game ranges (and game herds) are managed properly to protect the basic soil resource and maintain a protective watershed cover, the public interest might best be served with wildlife production as the dominant objective .

However, the public can be greatly misled by repetition of broad generalities. The impression that all acres can produce all products or values in harmony simultaneously is erroneous. An effective multiple use program is not something inherent to the management of a forest property—it has to be planned.

A realistic land use plan, revised periodically to keep abreast of current needs, can go far toward untangling some of the myths of multiple use. Game administrators and sportsmen should be vitally concerned with land use plans for public lands. If they are not, it may be from acceptance of the general statement that wildlife must be secondary (or perhaps even lower in the scale) to some other major use of the land.

In most cases the forest administrator will be sympathetic to the needs of game. Yet there are foresters whose interest in wildlife has been dampened by experiences with the fires of careless hunters, with overpopulated and depleted game ranges, with game damage to forest nurseries and plantations, with lack of monetary incentives to produce a wildlife crop, and in addition, by the philosophies that what is good for the forest (or range or watershed) is good for wildlife, and that wildlife is necessarily a by-product of some more important use of land. Some foresters may question whether, when lands are set up for wildlife, the management of game will be adequate to sustain the productivity of, and protective cover on, those lands. Generally, however, the past ten years have brought foresters and game managers closer together—in basic training, in cooperative approach to mutual problems, and in recognizing that wildlife is basically a product of the land. The field for cooperative land use planning is a fertile one for those game and fish administrators who recognize the opportunity and appreciate its importance.

Summary

Public thinking has been slow to accept changing needs of wildlife management. Obsolete measures persist to hinder reaching new objectives. To avoid pitfalls for future administrators we would do well to examine current educational emphasis critically. The two statements (1) good forestry is good for wildlife, and (2) wildlife must be a by-product of some other major use of land, while true in a general way, obscure the fact that much can be done, and needs doing, if wildlife is to maintain an important place in outdoor recreation.

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Forest-Fire Control in the Lake States

By J. A. MITCHELL

Abstract

Few regions have suffered as frequently or severely from forest fires as the Lake States. Before the white man, fires set by lightning or by the Indians burned uncontrolled in dry seasons and covered vast areas. Commercial logging and agricultural development following the Civil War set the stage for the catastrophic fires of the past century. Forest-fire control has come a long way in the last 50 years. The average number of fires has been reduced from over 10,000 to less than 4,000 a year and the average annual burn from over a million acres to less than 100,000, or 0.16 of 1 percent of the area protected. Today, protection from fire in the Lake States may be said to be reasonably adequate under normal conditions; but the threat of disastrous fires remains, and only constant vigilance and sustained effort can keep the situation under control.

Paper delivered at 1954 annual S.A.F. meeting and appearing in the published proceedings of that meeting.

Research in the Biological Aspects of Forest Production[1]

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WHETHER we like to admit it or not, forest production is a highly speculative proposition. The degree of speculation in the future will be related to the demands that society places upon the forest potential and the rate at which silvical knowledge is accumulated. One of the greatest deficiencies in the production aspect of forestry today is our general lack of ability to predict the species, form, and volume of the trees that will be growing on a particular area at a given time. This deficiency stems from the fact that we as foresters are working with a wild crop, and we simply do not have the degree of control which permits accurate prediction. Modern industry, the bond between forest potential and society, requires realistic predictions in order to function properly. Ultimately, sound decisions as to production policy must rest upon a firm foundation of knowledge; a knowledge which inevitably will be basically biological due to the inherent characteristics of the forests themselves.

Many problems of forest production have become apparent, although a great number remain to be generally recognized before they can be delineated and rationally approached. Our difficulties seem to originate from two major sources. When one views the first source with an extremely broad perspective, it emerges as the myriad of imponderables involved in the forester's attempt to evaluate the sum total of the reactions between the genotypes of the forest trees and their environments. This is what the forester is trying to do when he predicts the site quality of a wooded area. The second source of difficulties is as specific as the first is general. It involves the factor of time, an element which can be measured precisely and the requirement of which is considerable for the life cycles of most of our native tree species. The influence of time in the biological research of forest production has no parallel in any comparable area of investigation.

Methods of Approach

Research in the biological aspects of forest production can follow several methods of approach.

Experimental.—The one which will ultimately provide the major framework for scientific silviculture is often referred to as fundamental experimental research. Here, elaborate equipment and intricate techniques are employed to break down the physiological processes of plants into their physicochemical reactions, isolate them, and measure their variations under controlled conditions. Control is essential. The major efforts of plant physiology have been devoted to the lower plants and the herbaceous members of the higher plants. The application of similar experimentation on trees creates a whole set of problems of considerable magnitude. The highly trained plant physiologist in this country who concerns himself primarily with trees is rare indeed. One might even say that the science of plant physiology has not developed to the stage where trees as individuals, let alone in the form of forests, can be observed efficiently. One could probably state further that the basic problems related to the reactions of a tree with its environment are not in the hands of the forestry profession as such. This is not an admission of failure on the part of the forester but one of realism, of challenge. Here, then, lies a whole area of research responsibilities, a part of which could be shouldered by the "forest physiologist," if for no other reason than to assist in the recognition and decsription of the basic problems.

Empirical.—Another mode of research is as old as man and is the trial-and-error or empirical method. This manner of learning was largely responsible for the changes wrought in man's existence from one of a gatherer of wild plants and animals to one of a cultivator of domestic crops. Our whole civilization rests upon it. The primary difference between this mode of investigation in silviculture and in agriculture is the time factor that is so strongly in favor of the latter. The agriculturist also has at his command the advantages of over three thousand years of experience with a comparatively few food plants. The silviculturist has as his backlog of experience a few hundred years with a multitude of tree species.

Empirical investigation in forest production has been primarily descriptive chiefly because of the difficulties in achieving an adequate degree of control. Its motivation has been the pressure of practical problems. Plantations and sample plots of differently treated areas generally fall within this realm of research. The value of such research will be related to the manner in which it was originally conceived, and the amount and quality of the observations recorded during the many years of its continuous maintenance. When one considers the complexity of the problems involved, it would appear that a multitude of these projects will produce nothing more than a crop of trees, and many of these at great expense. The trial and error approach is very apt to defy accurate description, interpretation, and duplication.

Historical.—The third avenue to the biological problems of silviculture can be referred to as the historical method. This mode of investigation also has been employed for a long time. It is no accident that the major wheat belt in North

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America occupies the area which only a century ago was dominated by the mid-grass prairies. Trial and error, environmental manipulation, and genetics have altered the boundaries, but the outlines of the original vegetation still are almost intact. In this approach, the plants are considered as integrators of the total environment. Investigators attempt to reconstruct and interpret the expressions or trends in the development of the vegetation in the light of what has gone on before. With an historical background in hand, they can be more intelligent about what to expect in the future. The reasoning is primarily inductive.

Climate has often been defined as the succession of weather. A forest might be referred to as the product of a series of "nature's experiments." In this respect, a forest might also be compared with a technical library. The experiments are not cataloged but they are there just the same and need only to be recognized, interpreted, and evaluated.

One should be very conservative in appraising this means of deriving information. The method is chiefly one of fundamental description. No basic quantitative data regarding physiological processes or facets of the environment will result. The whys and wherefores of plant distribution will not be solved. However, definite facts of presence and absence of tree species will be exposed. Major fluctuations in the environment and the gross expressions of the tree vegetation to related changes can be observed. The time factor, always so influential, can be telescoped by meticulous application of simple techniques and judicious observation. The results of many years of "nature's experiments" can be scrutinized within a comparatively short time. New problem areas can be exposed and subjected to more elaborate experimentation.

The experimental, trial-and-error, and historical approaches to the biological aspects of silvicultural research cannot stand alone. All three, particularly the first, must of necessity take into consideration the principles of genetics. Eventually, all silvical knowledge must have genotypic qualification. Genetics can provide an impetus to forest production. The recognition, selection, and creation of particular genotypes will not only make it possible to grow better trees faster, but also assist in the analysis of the environmental complex.

Silvics, commonly defined as the biological foundation of silviculture, is in its embryonic stage of development. It is destined to become a science of synthesis, dependent upon the contributions of the allied disciplines for its foundation. The nature of the problems demands the application of the experimental sciences for ultimate solutions. As a result, answers will be a long time in coming. One might rationalize the situation by considering experimental research as the long-term approach, and descriptive research in the form of trial-and-error and historical methods as short-term approaches. Of the three, the historical is perhaps the least time-consuming. When one considers the present status of the development of silvics, the complexity of the problems, and the importance of time, it would also appear that the historical approach could be employed to the greatest advantage *now* toward the contribution of partial solutions for the silviculturist in the woods.

Application of Historical Approach

For a period of two years the historical approach was applied to an area slightly less than one acre, situated on the Harvard Forest in Petersham, Massachusetts.

The original objective was to trace the development of the vegetation to precolonial time, about 1730. The area was chosen because it supported a stand of trees, and it was accessible. The first procedure involved the construction of a 10-foot grid which permitted the accurate location of any observation one cared to record.

A series of maps was constructed to the scale of 10 feet to the inch which described:

1. All stumps, dead tree boles and large fragments of wood lying on the forest floor.
2. All live tree elements to a minimum d.b.h. of 1½ inches.
3. All live tree elements ranging from 1½ inches in diameter to the smallest recognizable seedling.
4. Contours of the forest floor to an interval of 6 inches.
5. Boulder concentrations on the surface of the forest floor and all individual boulders to a minimum diameter of 6 inches.
6. Present forest canopy.

Along with map construction other procedures were as follows:

1. Specimens of all the stumps and wood fragments were collected for identification and age determination.
2. As the tree elements less than 1½ inches in diameter were described, a section for age determination was removed from the base of each coniferous seedling and from the base of the stem and primary root of each sprout hardwood.

The 6-inch contours vividly delineated the microrelief of the area which included over 60 mounds and pits created by the uprooting of trees. The next major effort concerned the mounds and pits exclusively. Each was sectioned at right angles to its long axis, to depths of from 2 to 5 feet. Ten sections, the ages of which could be most closely determined, were profiled to the scale of one foot to the inch. Only the gross aspects of the sections were observed: color, consistence, texture, and arrangement of horizons. The remaining sections were diagrammatically profiled to the same scale and described. Coincident with sectioning, specimens were collected of buried wood from the trees that had been uprooted, buried organic layers of the predisturbed forest floor, and charcoal. The wood and charcoal were collected for identification, as was the pollen content of the organic layers.

The final stage in the field consisted of clearcutting the area. Sections for height and diameter growth reconstruction were removed at 4-foot intervals from each tree. So much for the general pro-

cedures except to say that the laboratory analyses involve a terrific volume of labor. Approximately 10,000 individual specimens were collected.

Findings

One of the first facts to be revealed was that in spite of at least two major logging operations, four periods of wind disturbance, and fires, the area had supported trees continuously since precolonial time. This fact has a significance which perhaps is so elementary that its real meaning is forgotten: that in this general region of the United States the developmental trends of the vegetation are climaxed by trees. This is the basic premise upon which our present-day silviculture and forest management are founded. The concept of plant succession was derived from the discipline of plant ecology, and provides the forester in New England with the basis for a reliable prediction: that any area in New England—those of obvious environmental extremes excluded—will produce a crop of trees if given enough time.

The majority of the trees whose uprooting had caused mounds and pits had been alive and quite large when uprooted. The individual characteristics of the mounds and pits indicated that at least four major periods of wind disturbance had occurred over approximately the last 500 years. Recently I had the opportunity to travel over 5,000 miles to the Cumberland and Smoky Mountains, south through the Piedmont Region, then west across the Mississippi Delta to the Quachita and Boston Mountains, and back to Massachusetts. Practically everywhere one looked mounds and pits of uprooted trees were found. One has no difficulty finding the same phenomena in New England. The evidence on the ground is substantiated by accounts in the literature of innumerable storms of varying intensities since colonial time. I have come to the conclusion that the mound and pit microrelief is as much a characteristic of the forests as the trees themselves. The question that I am forced to ask myself is: how does disturbance of this magnitude and frequency affect the climatic climax concept of vegetational development, a concept upon which much of our silvicultural and management practices are based? The climatic climax concept is founded upon a degree of stability that appears never to have existed in many forested regions. What adjustments do we have to make in our silvicultural reasoning to accommodate the influence of uprooting, of instability? Can the disturbances be predicted with reliability? Can the regions most affected be mapped?

The insertion of a disturbance or instability concept forces one to ask the same question about the development of soils. On the area under investigation it is possible to ascertain three different ages of soil surface within a horizontal distance of 20 feet. Over the area in general it is impossible to select one profile that can be designated as "typical," "normal," or "mature." The influence of instability upon soil genesis would appear to be an important consideration.

The stem analyses vividly revealed the height growth of the trees as individuals and of the stand in general. The hardwoods of one age class showed a period of pronounced decrease in height development. Further observation indicated that about 70 years ago the crowns of this age class were mechanically damaged. A severe ice or glaze storm was probably the agent involved. Regions of frequent and severe glaze storms are recognized by the electric power companies throughout the United States. So aware are they of this phenomenon that critical areas have been mapped, and in these regions adjustments have been made in the equipment employed to accommodate the weight of ice accumulation. What influence do ice storms have upon tree height growth and consequently upon the development of clear log length? Is clear log length actually limited by ice in certain regions? Can the frequency and occurrence of ice storms be predicted?

Had a forester cruised this particular area periodically every hundred years starting in 1650, his tally sheets would have shown quite different totals in regard to composition, dominance, and, of course, volume. The chances are that he would have assigned a different forest type designation to the stand that he found there each time. Which one of these "forest types" was real? Which one represented the true biological potential of the area? One might ask the same questions concerning the many different forest types now recognized in New England.

I have attempted to describe my concept of the historical approach to forest production research. I have cited only a few of the gross expressions of the vegetation to its environment and the simple techniques involved in their observation. It would appear that this approach could be applied very advantageously at this stage in the development of scientific silviculture. Its major objectives could be the determination of the "natural" biological production potential of forested areas and the degree of flexibility they present to environmental manipulation. Admittedly, most of the information derived would be descriptive in nature and would undoubtedly fall by the wayside as the experimental sciences came into play. Regardless of the nature of the knowledge, it is needed now, and much of it is destined not only to provide a framework for further investigation but also to contribute to the basic foundation of scientific silviculture in the future.

A basic question involves the degree of accuracy with which one should expect to predict the biological potential of an area. There are innumerable agricultural areas in the Midwest, for example, that have not experienced a crop failure in 50 years. I do not imagine that the proprietors of these acreages would have any difficulty financing improvements through a bank loan. However, move these same areas west near the margin of the 30-inch annual precipitation zone and observe the degree of

speculation mount. The inherent characteristics of our forests will never permit the degree of prediction exercised in agriculture. However, a forest industry should be able to undertake a land procurement program with reasonable certainty that the acreage they obtain will meet the demands which are to be placed upon it. A silviculturist should be able to realize the risks involved and the chances of attaining his objectives when he attempts to grow trees with two clear logs of a particular species and size in a prescribed length of time. As we learn to manipulate the environment to coincide with the silvical requirements of a plant, or to adjust the genotype to the environment, we shall be able to predict results more accurately.

Conclusion

In the future, I believe that we should be very realistic about our research in forest production. Not necessarily practical, but realistic. All scientific investigation consists of accumulating observations. The subjects being scrutinized vary tremendously as do the techniques employed. Nevertheless, the first objectives are the same: the recording of accurate observations. Ultimately the data are synthesized. Conclusions are derived which lead to a partial solution. Another facet of knowledge has been exposed, and an additional plane has been established on which further reasoning can be based for an approach to another set of unknowns.

During the initial stages in the development of silviculture, the description and empirical methods of research could probably be employed to the greatest advantage. After these have been exploited to reveal the gross biological phenomena of forests, the application of the experimental method will come into full play. It would also appear that the forester could accept more of the research responsibilities pertinent to the biological aspects of forest production.

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A Permanent Plot System of Survey For the Continuous Inventory of Ponderosa Pine Stands In the Southwest[1]

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CONTINUOUS INVENTORY, as it was first conceived and as described by Kirkland (*3*), involved periodical remeasurements of the entire stand to facilitate very intensive management. However, more recently, it has also been used, possibly more loosely, to describe a remeasurement of permanent sample plots at a given interval. This interval may vary with the rate of growth, the length of cutting cycle, revision of the management plan, or most any other stand factor desirable to the manager. It may be applied to strips, blocks or circular plots; but the unit should be definitely established and capable of exact remeasurement. Meyer (*5*) says "The calculation of the periodic increment based on nonpermanent strips will be rather difficult, because the mean error in the estimated volume of the forest is comparatively high. This will cause the error of the increment to be still higher."

Continuous inventory is not a new idea. It originated in France about 1880 as the *Methode du Controle* and was then developed in Switzerland. There have been many papers prepared on the subject. Some authors have advocated the use of the individual tree as the unit. Others have accepted the stand as the unit. Both approaches, undoubtedly, have their advantages and defects.

To the best of my knowledge, Meteer's paper (*4*), in the JOURNAL, has been the only recent report on a system using the individual tree. The method appears to be workable, relatively simple, and readily applicable to experimental and precisely managed stands. It is conceivable, however, that the volume of cards could be too large to be of much use to the manager on most of our larger timber tracts in this country. The cards could be summarized and used as a stand unit, but there would be considerable work in posting, which might be of little value in itself. Also, an individual tree record requires a system of numbering, which entails considerable extra work to maintain.

Buell, Wahlenberg, and Gross (*1, 7, 2*) recommend the total stand approach, with data in a form to permit calculations on the basis of diameter classes. if desirable. By this approach, certainly, the records are reduced; and the basic results and summaries are readily available to the manager.

Forest mensuration in the Southwest has run the usual gamut from ocular estimates, which were later checked with strip cruises and sample plots, through intensive strip cruises by individual G.L.O. sections. The ocular estimates were not sufficiently accurate nor detailed for management purposes and the strip cruises gave no information except the volume and stand composition on the date of the cruise. The cruises were also very expensive. Figures on net growth were very sketchy and it was not known whether or not they were applicable to wide areas of the Region. The Forest Survey has never been extended to the Southwest and thus

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their information was not available. To add to the difficulties the percentage of cut has varied through the years from as high as 85 percent to as low as 25 percent or 30 percent. Cutting cycles have been reduced from 60 or 65 years to 20 years.

On the basis of the information available it was almost impossible to prepare dependable long range management plans. To prepare any plans an accurate estimate of the present volumes and stand composition was needed immediately. Some information on growth and mortality in stands of various densities and compositions must be obtained in a short time. Eventually information on optimum volume and composition of residual stands by site classes and forest types would be needed. Information in hand did not make it possible to determine how much stand improvement work was economically possible or desirable nor what the stand density should be to get the optimum rate of growth and quality. Also, it was impossible to tell what was available for industries new to the Southwest or when they might become economically feasible.

Fortunately, improved aerial photography and survey techniques permitted stands to be analyzed with a minimum of field work. Accurate sampling became possible through measurement of only a very small portion of the stand. With these new tools, whole working circles could be sampled at a cost equal to or less than that required to cruise the area cut over annually by the old intensive method.

The working circle could be measured periodically to determine what was available for cutting; and, by adding removals and subtracting recorded losses, a net utilizable growth would be directly obtained for the period.

However, some obvious questions were immediately evident. How many plots must be taken? What types of plots should be used? What limits of error would be acceptable? Should the stand be classified and, if so, how? How often would remeasurements be planned? Should the plots be marked on the ground or made inconspicuous? Were records by individual trees necessary? Finally, would the results be usable?

The Flagstaff Working Circle is in the heart of the southwestern pine belt and the most important unit in the Region. It was, therefore, natural that the attempt to answer these questions was started on this unit. There are some 800,000 acres in the pine type of the working circle, and cutting has been in progress since the early 1880's. The type of removal in the virgin stand has varied from clear cutting to the present harvest of 35 percent to 40 percent of the stand. Nearly every stage in composition and density of ponderosa pine is present on the area. Study indicated, however, that it could be divided roughly into 6 units or blocks on the basis of past treatment, topography and soil.

To get to the methodology, we experimented with ¼ acre plots clustered around each G.L.O. section corner, but the results were not very satisfactory. At about this time, other Forest Service regions and Experiment Stations were, also, experimenting with sampling design. Thus, it was that we finally developed the over-all plan for the Flagstaff Unit based on a composite of ideas and research results of our own and of others concerned with similar problems.

It was determined that in the Southwest, the average coefficient of variation of stand volume per plot would not often exceed 86 percent. Because of the relatively large size and volume involved, and the established community dependence upon the working circle, it was felt that the standard error of volume estimate should be not more than ±4 percent, one standard deviation. On this basis, 450 plots were required to adequately sample the Working Circle. Work by the Northern Rocky Mountain Station indicated that the ¼ acre circle was apparently the best suited to estimate volume in the open pine stands and thus it was adopted for this cruise.

To measure the poles and reproduction on the entire ¼ acre would have been laborious and apparently an unnecessary refinement. Thus, circular plots of 1/10 and 1/50 acre, respectively, were used concentric with the ¼ acre plot to tally the poles and reproduction.

Work on the Fort Valley Work Unit of the Rocky Mountain Forest and Range Experiment Station indicated that mortality could not be recorded accurately on the ¼ acre plots alone, because it was more variable than volume or gross growth. To overcome this, a mortality strip, one chain wide and 10 chains long, was established with each plot. The strip was run up or down the slope from the plot center, if possible, but always kept in the timber type. Snags were permanently marked and measured within the strip. This is to be repeated each time the plot is remeasured, thus giving the volume lost through mortality during each period between measurements.

Recent aerial photos on a scale of 1:20,000 or 1:15,840 were used to classify the timber on the basis of the Region 3 typing scheme. This system shows over and understory type, age and density within coniferous saw timber stands, classified as to condition such as cutover, virgin, inaccessible, denuded by fire, wind, etc.

The plots were stratified by blocks on the basis of area only, because knowledge of differences in variance between blocks was not available. Plots were located on the aerial photos by strictly random methods. The centers were marked in pencil and circled with crayon to make them readily discernible. Each plot was numbered on the back of the photo as located. Plots falling in types other than saw timber were discarded and no number assigned. All of the plots computed to be necessary were located prior to doing field work.

After plot location work was completed on the photos, this data was transferred to planimetric maps and routes laid out to visit the plots with a minimum of travel.

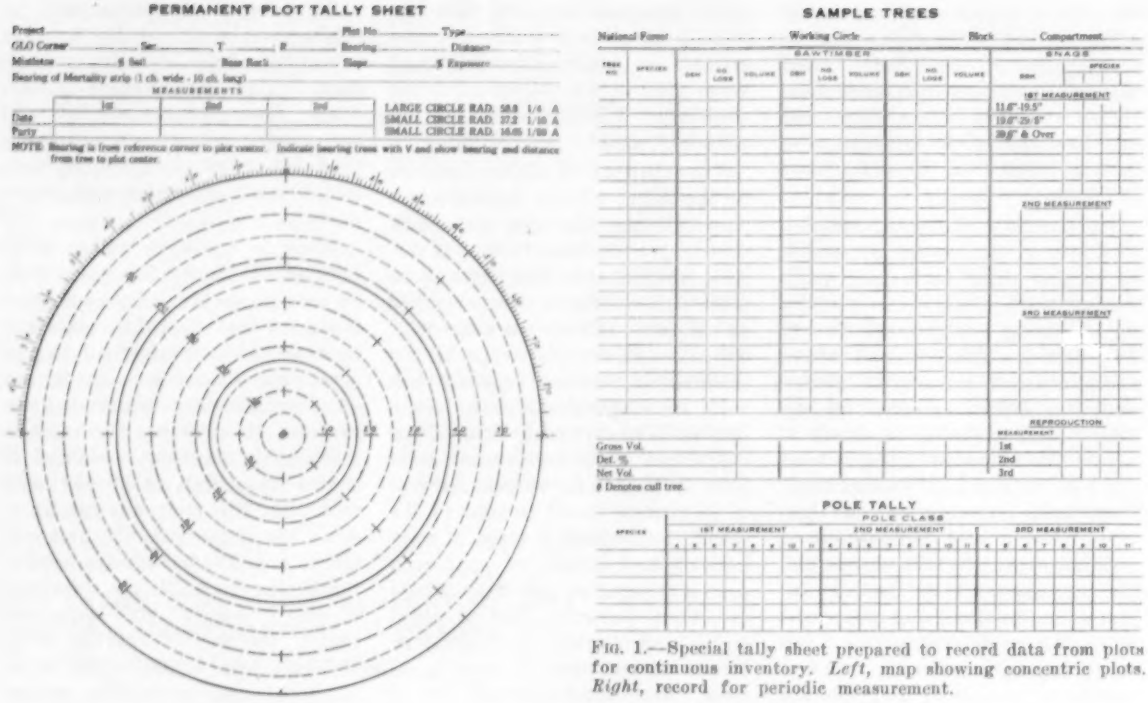

FIG. 1.—Special tally sheet prepared to record data from plots for continuous inventory. *Left*, map showing concentric plots. *Right*, record for periodic measurement.

Usually a 2-man crew was used to collect the data, though the work could be done with one man.

Plots were located on the ground directly from the photos, if some distinguishing feature was close to the plot center. Otherwise, the location was by reference to some readily distinguishable point near the plot. When reference points were used, the plot was located on the ground by scaling the course and distance from the photo and measuring on the ground by compass and pace. The last pace was the plot center. Reference points and plot centers were pin pointed on the pictures after location on the ground.

Centers of the plots were marked on the ground with a metal stake tagged with the plot number. Two young, thrifty trees were wood blazed on the side toward the stake and marked with the plot number to witness the center. A band of white paint around these trees makes them easily distinguishable for future reference.

A special tally sheet was prepared to record the data from the plots. (Fig. 1) On one side is a map showing the 3 concentric plots and on the other are spaces to record each measurement 3 different times, making comparisons over a period of years readily possible.

All trees 11.6 in. d.b.h. and over were mapped within the ¼ acre circle and given a key number. Their d.b.h. was marked with an aluminum nail and measured to the nearest inch. Heights to an 8 in. top were measured to the nearest 8 ft. or half log. All volumes were computed on a gross basis on the tally sheets.

Poles between 3.6 in. and 11.5 in. d.b.h. were mapped on the 1/10 acre plot, and the diameter class shown on the sheet. Their d.b.h. was marked with an aluminum nail, and measured to the nearest inch. Reproduction 1 foot in height to 3.5 in. in d.b.h. was counted on the 1/50 acre plot. No attempt was made to map the location of the individuals in reproduction size classes.

The above measurements were made only on plots falling within the cut-over stands. Those falling within virgin stands were measured for present volume of saw timber, poles and reproduction, but d.b.h. was not marked. Height of saw timber was recorded to the nearest 16 ft. log, poles were classed only as large and small. none of the trees were mapped, and no iron stake was set at the plot center. Witness trees were marked and painted, however, to make the plot readily found after cutting.

It was felt that time spent in measuring and marking all of the trees in the virgin stand would be wasted, because of the apparent little or no net growth, and because cutting of the virgin stands is scheduled to take place within the next decade. Immediately following cutting, it is planned to establish the permanent plots with mortality strip, and measure them as was done on the plots falling within the cut-overs at the time of the cruise. The uses and purposes of the plots have been thoroughly discussed with the timber sales men, and we believe timber marking for the initial harvest in the virgin stands will not be influenced by the existence of the permanent plot locations.

Work on the Rocky Mountain

Station indicated that about 12 times as many plots are required to sample growth as are necessary to sample saw-timber volume to the same degree of accuracy. The Flagstaff plan was made to sample volumes. However, if a volume figure is obtained at intervals for the stand and removals during the interim considered, a figure of merchantable growth for the stand should be indicated. As management becomes more complete, this growth figure may become fairly stable by individual stands and by residual density classes. If this occurs, the plots will have served their purpose as far as growth is concerned. Growth rates by individual trees are apparently relatively unimportant in the Southwest at present (*6*).

The system promises, too, to afford the simplest way to determine volume on which to base annual cuts and is expected to be useful indefinitely. Maintenance should not be a difficult nor a costly task as compared to setting up and locating new plots for periodic cruises.

As stated previously, there are still many factors important to management for which definite answers are not available. Of most obvious and immediate importance is the variance that might occur in plot volumes by stand composition classes. With this information, perhaps remeasurement of some plots will be unnecessary, thus reducing costs. The survey was set up on the basis of a variance close to the maximum experienced in the vicinity to be sure a sufficient sample was being taken to measure cut-over stands.

We expect, in addition, analysis of the plots at 10-year intervals will give data on the effect of site on growth and volume, the optimum residual stand composition for growth in specific areas and the optimum length of cutting cycle to reduce death loss to an economic minimum. Also, as management is intensified, it is anticipated that a need will develop for more knowledge than is now available regarding the growth and form development of individual trees under various forest conditions. This will be possible by refined analysis of individual tree data available on the plot tally sheets.

All of the foregoing possible by-products of the data that the permanent plot system might yield were considered in the initial survey plan. It was felt that it was better to be generous with the number of plots and refinement of data than to find out that insufficient sampling was being done, or incomplete data being collected, after a few years of experience with the system.

At present, as indicated, it is planned to rephotograph the area and remeasure the plots at 10-year intervals. After a few remeasurements and/or closer analysis of individual plot or individual tree data, it may appear beneficial to maintain a smaller sample, remeasuring it at some other interval; or it may develop that rephotographing can be delayed for a longer period. It will require time to obtain the answers. In the meantime, little more work is being done than would be required to adequately sample volumes for management plan revisions.

Cost of the survey including all of the plot establishment procedure and aerial photography was about 2.2¢ per acre. The cost of remeasurement, including photography, will be far less, perhaps not over half of the initial survey cost.

We are sufficiently enthusiastic in the Southwest about the improved management data that this system of forest inventorying promises to yield, to adopt it for region-wide use and it is being employed on all new management survey projects. We claim no credit for having originated any new or startling concepts or techniques. We feel, rather, that we have merely put to practical use the applicable results of work and research done in the Southwest and elsewhere. From it we confidently expect to get increasingly sound guides upon which to base our forest management programs.

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Quantity and Hydrologic Characteristics of Litter under Upland Oak Forests in Eastern Tennessee[1]

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ALTHOUGH LITTER is a major source of organic matter for forest soils and fundamental information on its classification, structure, and composition constitute an imposing volume of literature, we find that information is meager on the quantity and hydrologic characteristics of litter occurring under certain forest types and in certain regions. The Tennessee Valley Authority, in its program of forest development, timber production, and water control on the land, is concerned with what happens to the 50-inch rainfall each year on the 14 million acres of timberland in the Tennessee River Watershed. Accordingly, this study was made to determine the character of litter under the extensive upland oak forest in eastern Tennesee. This report presents estimates of total litter sampled under different stands at intervals of several years. Results for an upland oak stand include quantity of leaf fall as related to net accumulation during the year and the moisture-holding capacity of litter as related to occurrence of rainfall.

Review of Literature

Annual leaf fall reported for hardwood and mixed stands in eastern United States ranges from 2,400 to 3,100 pounds per acre (*10, 48*). For pine stands in Florida, Minnesota, and New York the range was from 1,700 to 3,500 pounds per acre (*2, 11, 21*). Mork (*39*) found that annual litter deposits in Norwegian timber stands varied from 700 to 3,000 pounds per acre. Coldwell and DeLong (*13*) show that average annual weights over a 3-year period for several species in mature Canadian stands ran from 1,500 to 3,000 pounds. Lunt (*34*) in Connecticut reports that annual needle fall was 21 percent greater for white pine than for red pine. Metz (*38*) states that in hardwood stands in South Carolina approximately 15 percent of the annual litter fall was twigs, bark, and fruit. Usually the annual fall of litter does not decompose completely in one year. This means an accumulation from year to year. The amount depends on forest type, soil type, and climatic conditions.

Sims (*48*) reported pine-oak litter accumulations of 3 to 4 tons per acre in North Carolina. Auten (*4*) found accumulations of 7 to 10 tons per acre in oak stands in the Central States region. Perry and Burrage (*44*) in studies of upland oak stands in eastern Tennessee, sampled at 5-year intervals, found litter varied from 6 to 8 tons per acre—with minor increase with lapse of years. Alway and Kittredge (*1*), sampling the forest floor under aspen-paper birch stands in the Lake Superior region, found that weights varied from 4 to 21 tons per acre. Stands of conifers in various sections of the United States show total litter weights varying from 3 to 27 tons per acre depending on species and age (*5, 7, 15, 28*).

Frank (*18*), Lull and Munns (*31*), and Munns (*40*) have pointed out the need for both additional knowledge and application of what we already know about the effects of management on soil and water conservation. Forest fires and grazing destroy the litter and humus that protect the soil surface. Loss of this soil mantle causes runoff, sheet erosion, and a decrease in the growth rate of trees. Perry and Coover (*43*) found a reduction of 60 to 70 percent in the volume growth of trees on frequently burned sites as contrasted with similar trees on protected sites, despite the wider crowns and more growing space on the burned areas. Rowe (*46*), in his studies in central California, reported surface runoff and erosion were markedly increased by annual burning. Rycroft (*47*) stated that autumnal burning in South African veld drastically increased volume of stream-flow and flood heights. Trimble, Hale, and Potter (*50*) found that livestock grazing in Allegheny woodlands reduced the organic content of the humus layer by 32 percent. Chandler (*9*) and Johnson (*26*) state that the grazing of farm woodlands results not only in the destruction of the forest tree reproduction, but also in a decreased growth rate and vigor of the trees due to deterioration of site. The annual removal of litter from woodlands for bedding of livestock, as practiced in European countries, can also prove harmful to tree growth (*41*).

Several investigators report significant differences in infiltration for soils covered with litter as compared with denuded, burned-over areas or erosion pavements (*3, 6, 25, 27, 29, 49*). Lowdermilk (*30*) states that forest litter is far more important for maintaining percolation capacity of soils than for absorption of rainfall. Meginnis (*36*) reported that during the flood of the Yazoo River in Mississippi, surface runoff from undisturbed forests was much less than from old fields.

Factors that aid in the decomposition of the forest litter are physical, chemical, and biological. Each one performs a definite function, but they are all integrated into the process of breaking down the organic matter into humus and topsoil. Physical properties such as species composition, temperature, and moisture strongly influence the manner and rate of decay (*17, 19, 20, 42*). Some chemical properties that provide for rapid decomposition are water-soluble organic mat-

[1]Recognition is due J. S. Rothacher, formerly with TVA, and W. H. Cummings, formerly chief, TVA Forest Management Section, Forestry Investigations Branch, for their assistance in planning and conducting the study.

TABLE 1.—DESCRIPTION OF STANDS STUDIED ON NORRIS RESERVOIR BY MAJOR SPECIES, BASAL AREA, AND QUANTITY OF LITTER

Stand number and history	Major species by d.b.h. class					Basal area per acre, trees over 5.0" d.b.h.	Age of dominant stand	Period of study	Total litter during period	
	Less than 5.0"	5.0" to 11.0"		Over 11.0"					Start	End
	Species[1]	Species[1]	Basal area	Species[1]	Basal area				Weight per acre[2]	
			Percent		*Percent*	*Sq. ft.*	*Yrs.*	*Yrs.*	*Tons*	*Tons*
1. Heavy cut about 1933	Swd WO	Swd WO	13 9	ScO BO	27 13	41	78	2	4.5	4.2
2. Burned 1944	Dwd	ShP WO	7 7	BO ScO	49 14	77	68	5	2.2	11.5
3. Burned 1945	Dwd BW	ShP WO	12 4	BO Hick	40 12	94	85	4	3.5	11.8
4. Light improvement cut 1945	Dwd	ShP SRO	20 4	ShP BO	37 8	74	77	4	8.8	8.4
5. Light improvement cut 1945	YP WO	WO YP	13 5	WO Hick	50 13	61	85	4	4.4	8.5
6. Selectively-logged 1943	YP Dwd	YP Per	42 6	YP BO	31 7	50	37	5	8.9	4.2
7. Selectively-logged 1943	Dwd Swd	ShP BO	12 10	BO ScO	33 18	72	74	5	9.4	9.6

[1]Species abbreviations: BO, black oak; BW, black walnut; Dwd, dogwood; Hick, hickory; Per, persimmon; ScO, scarlet oak; Shp, shortleaf pine; Swd, sourwood; SRO, southern red oak; WO, white oak; YP, yellow-poplar.
[2]Total litter quantity based on field weights, except for stand 1 where weights are oven dry.

ter, percentage of nitrogen, acidity, and excess-base content; others, such as the lignin complex, waxy substances, resins, and hemi-cellulose content, slow up decomposition (*8, 13, 22, 37, 51*). Biological agents assisting in the decay of the forest floor include fungi, bacteria, earthworms, insects, and myriapods (*14, 16, 23, 35*). An example of the interaction of these agents is reported by Coile (*12*) who states that calcium aids decomposition through its reduction of acidity, which in turn has a profound effect on the microbial population that feed on organic matter.

Description of Study Areas

This study deals with stands typical of east Tennessee. They represent fair to good upland forest sites on Clarksville and Fullerton cherty silt loam soils in the ridge and valley province of the Great East Tennessee Basin (Fig. 1). Essential information is given in Table 1 on the seven stands used in the litter study. These stands were also identified with other studies. Stand 1 is the sample acre of typical cutover hardwoods used in the Clear Creek transpiration study established in 1948 (*45*). The other stands, Nos. 2-7, were used in a test established in 1945 and 1946 of nitrogen fertilizing following fire or cutting. However, the results on litter given here are only for the unfertilized or check plots in these stands. The history (Table 1) of these stands includes burning by wild fire that destroyed nearly all the forest floor, improvement cutting that removed weed species, and selective logging of overmature and defective trees. In composition, upland oaks are dominant in these stands except for shortleaf pine in Stand 4 and yellow-poplar in Stand 6 as indicated by major species in Table 1. These stands are uneven-aged with a light saw-timber volume, understocked with pre-sawtimber-size trees, and with dogwood prominent in the understory.

FIG. 1.—Stand 7, a typical selectively logged stand in eastern Tennessee where litter studies were conducted.

Study Procedures and Results

For the purpose of this study the term litter is that part of the forest floor including:

1. The L layer, or unaltered remains of plants and animals.
2. The F layer, consisting of partly decomposed organic matter.
3. That portion of the H layer that could be readily separated from the mineral soil with the fingers.

Large branches and other organic debris that would distort the sampling were excluded.

A uniformity trial to determine the size and number of samples of litter to give a standard measure for a predetermined percent of precision was made on 1.6 acres of plots in Stand 5, using three frame sizes: 1/100-, 1/10-, and 1/4-milacre, with 128 samples for each size. The 1/10 milacre sampling unit had the most stable coefficient of variation, so this size was selected for the sampling work. This trial showed that 40 sample units would give the weight of total litter on an acre with a standard error of 5 percent. Representative sampling was obtained by stratification, with four sample units randomly located on each tenth-acre.

The sampling technique was simple. Equipment included (1) a wood frame 2.08 feet square giving a 1/10-milacre sampling unit; (2) a set of screens—one coarse (½ in. hardware cloth) and one fine (No. 12 window screen), (3) a sharp, square-edged spade, (4) a light cardboard weighing box, and (5) household scales gradnated in tenth pounds. The frame was laid on the litter and an exact area was outlined by cutting with the spade along the inside edge of the frame. The litter sample was then spread out on the coarse screen seated on top of the fine screen. Twigs over ¼ in. diameter and other coarse debris were picked out. After sorting, the balance of the coarse litter was transferred to the weighing box. Next, the contents of the fine screen were shaken to eliminate any mineral soil, and the remaining organic matter was added to the weighing box. Then the total litter sample was weighed, recorded and returned to the ground.

Total litter. — Total litter was measured in Stand 1 at bi-monthly periods from June 1948 to August 1950 to determine the increase by leaf fall and decrease by decomposition. Forty samples were collected every two months, the litter being returned to the ground after sample weights were recorded. Other small samples were taken nearby and oven-dried to determine the moisture content of litter at the time of sampling. This provided the basis for computing the dry weight of total litter on the acre. Figure 2 shows total litter accumulation and current leaf fall on the sample acre over the two years. Total litter weight varied significantly between sampling periods and follows a definite trend during the year with the exception of February 1949, which is considered erratic. The greatest accumulation averaged 5.5 tons per acre in December, which includes nearly the total leaf fall. During the early summer months the rate of decomposition is sufficient to decrease the average amount of litter to 4.2 tons per acre by August. The decrease from December to February suggests that there is some decomposition even during the late winter in this climate. The most stable measurements were those made in August. Apparently during this dry midsummer period leaf fall and decomposition are at a low ebb and nearly in balance.

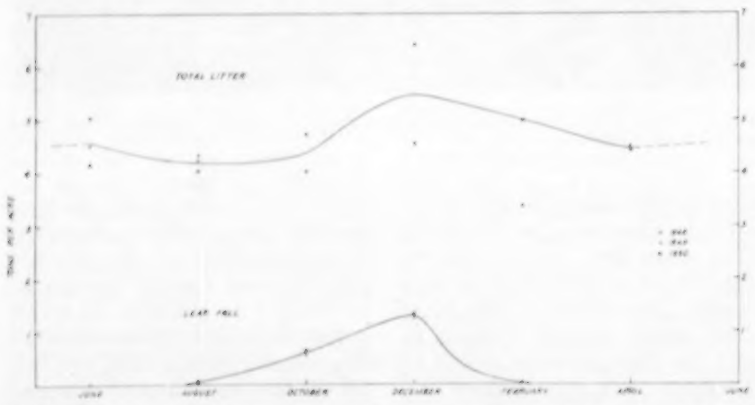

FIG. 2.—Weights of total litter and leaf fall for a two-year period under upland oak Stand 1 in eastern Tennessee.

Measurements of litter were taken on the fertilizer study plots (Stands 2-7) at time of establishment, after two years and at the end of five years. Random samples were collected in June when the litter was dry.

Table 1 lists the field weights of litter for the check plot in each stand at the start and at the end of the study. The variation in weight of litter was statistically significant, both for the three times of measurement and for the six stands. Of special interest is the rapid increase in litter weight following fire. In Stands 2 and 3, burned in 1944 and 1945, small quantities of litter remained. Average litter weight in these two stands increased from 2.8 tons to 11.6 tons per acre during the five-year period. In stands where light improvement cuts were made, the litter weight showed a definite increase in Stand 5, which is dominantly oak, but not in Stand 4 where shortleaf pine predominated in the overstory. In Stand 6, located in a cove, a heavy selective sawtimber cut in 1943 changed the cover type from mixed hardwood to nearly pure yellow-poplar. Here the distinct loss in field weight from 8.9 tons to 4.2 tons during the five years is attributed to a change in the character of the litter, that decomposes more rapidly than mixed oak litter. In Stand 7, located on a ridge, where only overmature and decadent trees were removed, there was a very slight (from 9.4 to 9.6 tons) increase in five years.

Current Litter.—Current litter,

chiefly leaf fall, and its rate of accumulation were measured in Stand 1 from August 1948 to April 1950. Forty screens, each 6 square feet in area, were placed on the ground to catch the leaf fall. Later the screens were covered with burlap to prevent fallen leaves from skidding off. Leaves of the 1948 crop were collected from the screens in August, October, December, February, and April and separated by species. Samples of leaves of the major species were oven-dried to determine the total weight. Small twigs and acorns passing ½-inch screen were also included in total current litter weight.

The amount of current leaf fall follows a pattern normally expected in a hardwood stand (Fig. 2). A small quantity, 0.05 ton per acre, falls in August. By October, another 0.55 ton has fallen, by December another 0.70 ton. The measured total annual leaf fall averaged 1.3 tons per acre for the two seasons.

The average annual leaf fall is reflected in the curve (Fig. 2) showing the accumulation of total litter. As leaf fall progresses during the fall months, the weight of the litter on the ground builds up to average 5.5 tons. Actually both curves would be expected to reach a peak in early November when the leaf fall is nearly complete, although this is not shown by the data collected. The average weight of foliage on the same sample acre obtained by estimating the foliage is summarized in another report[2] as follows:

Month and year	Foliage on trees Pounds per acre o.d.w.
1948	
June	2,630
August	3,100
October	3,200
1949	
June	3,170
August	3,340
October	2,800

The June sampling for the two years showed an average foliage weight of 1.4 tons per acre, August 1.6, and October 1.5. This variation during the growing season is due to leaf development and leaf fall. The total number of leaves at time of sampling, as estimated by regression equations, averaged 9 million per acre.[2] Foliage on all trees greater than 0.5 inch d.b.h. averaged 1.5 tons (oven-dry) for the 2-year sampling on Stand 1.

Table 2 shows the quantity of foliage and progress of leaf fall by major species. The understory species of sourwood, black gum, and dogwood lose their leaves earlier than the overstory species. For the two seasons of the study an average of 4 percent of the leaves fell by late August, an additional 42 percent by mid-October, and the balance of 54 percent by early December. This accounts for all major leaf fall except for an estimated 10 percent of white oak leaves and a minor amount of post oak leaves which persist until April.

Moisture Content of Litter.—Moisture content of litter was sampled in Stand 1 at various times during 1948 and 1949, during dry and wet periods, also at different times during the day. Field moisture content was determined on all 66 samples by oven drying to a constant weight at 100°C. Water-holding capacity was determined for 60 samples. These were soaked in water for 90 minutes, allowed to drain 30 minutes, then reweighed, and finally oven-dried to a constant weight at 100°C.

Moisture content of litter was analyzed in relation to relative humidity, amount of rainfall, and number of days since the last rain of 0.25 inch or more. The amount of rainfall and relative humidity showed only insignificant influence. However, number of days since last rain gave a highly significant correlation with litter moisture content. This relation was described by the regression equation: Log of moisture percent = 2.1278 —0.5125 log of days since last rain. It is presented as a curve in Figure 3 for the estimation of moisture content of litter. One day after a rain all excess water is apparently lost and the moisture content of the litter stands at field capacity, amounting to 135 percent. Moisture loss progresses at a rapid rate to approximately 41 percent after ten rainless days. Then it continues, but at a much slower rate, down to a minimum moisture content of about 20 percent, with slight diurnal variation due to relative humidity. Litter samples collected a short time after isolated storms contained as high as 150 to 175 percent moisture, which accounts for the temporary detention storage that occurs immediately after a major rain. This range is indicated in Figure 3 as the broken portion of a curve above indicated field capacity.

The moisture content of the series of samples saturated in the laboratory ranged from 200 to 250 percent of the oven-dry weight. This saturated condition represents the maximum water-holding capacity for the litter in contrast to the field capacity of 135 percent.

TABLE 2.—QUANTITY OF FOLIAGE ON TREES AND PROGRESS OF LEAF FALL FOR 1948 CROP OF LEAVES BY MAJOR SPECIES ON THE ONE-ACRE TRANSPIRATION STUDY (STAND 1)

Species	1948 foliage on trees			1949 foliage on trees			Leaf fall in percent for 1948 crop		
	June	August	October	June	August	October	August	October	December
	Pounds o.d.			*Pounds o.d.*			*Percent*		
White oak	370	440	420	700	650	350	0	16	74[1]
Black oak	400	460	530	320	520	330	0	3	97
Scarlet oak	570	870	780	850	760	800	1	12	87
Chestnut oak	90	100	100	70	130	120	0	4	96
S. red oak	160	240	160	230	190	200	0	43	57
Post oak	40	30	60	—[2]	40	—[2]	0	71	29
Hickory	130	—[2]	180	100	190	90	0	52	48
Sourwood	260	310	—[2]	310	360	330	1	99	0
Blackgum	70	70	—[2]	90	90	70	63	37	0
Dogwood	80	90	—[2]	70	70	100	3	72	25
Red maple	40	30	—[2]	—[2]	30	—[2]	0	32	68
Shortleaf pine	290	190	370	250	210	240	0	20	80

[1]Of the remaining 10 percent, one-half was lost by February and the remaining half by April.
[2]Not sampled.

[2]Rothacher, Jack S., Frank E. Blow, and Sara M. Potts. Estimating the quantity of tree foliage in oak stands in the Tennessee Valley. JOUR. FORESTRY 52: 169-173. 1954.

Discussion

The average annual leaf fall of 2,600 pounds per acre found in a mixed oak stand (No. 1) in eastern Tennessee compares with the 2,400 to 3,000 pound range reported by Sims (*48*) for a pine oak mixture in North Carolina and by Chandler (*10*) for second-growth hardwood stands in New York. The range from 2 to 12 tons of total litter per acre found in this and other stands in eastern Tennessee is attributed to stand history. The expected build-up of litter in burned stands indicates a considerable period of time is needed before the litter accumulation reaches the point of equilibrium recognized in other investigations (*24*).

The average amount of precipitation held by the litter under field conditions amounts to approximately 135 percent of its oven-dry weight. This amount caught, held, and evaporated after each isolated storm is equivalent to 0.05 inch of rain. It is conservatively estimated that the litter intercepts and returns to the atmosphere 1 inch of rainfall annually in this area where the total averaged 52 inches for the past five years. However, the value of the litter layer in retarding evaporation from the soil surface outweighs this minor amount of precipitation that does not reach the soil. Moreover, the litter retains some excess water after a heavy rain, serves as a temporary reservoir, and also maintains soil conditions more favorable to infiltration. On trenched plots of another study in this stand it was found that the upper 4-inch soil layer of bare ground was 20 percent drier than litter-covered soil.

Lowdermilk (*30*) reported an average maximum water-holding capacity of 180 percent on an air-dry basis in pine-fir litter in California. In the oak forests of eastern Tennessee the maximum water-holding capacity on an oven-dry basis averaged 225 percent. Using an average of 35 percent moisture on air-dry litter, then the average water-holding capacity of oak litter on an air-dry basis would be 190 percent.

The correlation of the number of days since a rain of 0.25 inch or more with the amount of moisture in litter has direct application for determining indexes of forest fire danger in upland oak forests in eastern Tennessee. The steepness of the curve (Fig. 3) for the first few days after a rain indicates the rapid moisture loss by evaporation during that period. After about twenty days further moisture loss from the litter is relatively minor. Beyond this point, it is possible that variation in relative humidity can become an important determinant in fire danger.

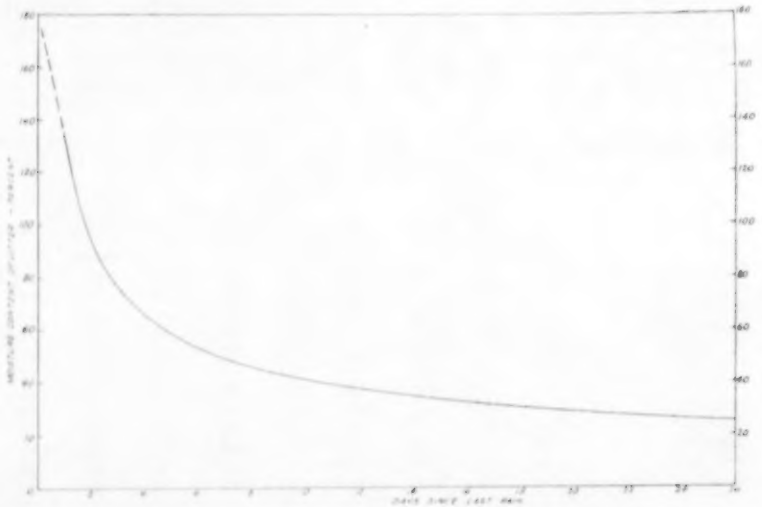

FIG. 3.—Average moisture of litter based upon 66 observations under upland oak Stand 1 in eastern Tennessee.

Removal of the litter by burning, or otherwise, destroys this absorptive layer. Rainfall then strikes the soil directly which results in excessive run-off. Recent experience in the fall of 1952 in east Tennessee has shown that the entire litter layer can be consumed by fire on extensive areas, thus resulting in extreme soil exposure. Although this litter can be replaced gradually by leaf fall, permanent damage may have been done to the site.

The nutrient content of leaf litter has been reported by several workers in this field (*2, 10, 11, 32, 33, 38, 39*). In general, it seems that hardwood litter contains more of the essential elements than coniferous litter. Metz (*38*) proposes that understory species such as dogwood and redbud are desirable in pine stands. The higher calcium content of these leaves would assist in faster decomposition of pine needles. Others contend that decomposition is more rapid in mixed stands due to the same effects. These nutrients, contained in more than a ton of hardwood litter deposited each year, should be of great value in maintaining site quality.

Prudent management of hardwood forests involves more than production of stem-wood. Maintaining normal leaf fall and litter accumulation is also an important function of site management. Practices that retain the litter layer and preserve the physical, chemical, and biological factors that control decomposition aid in maintaining maximum site quality.

Summary

The quantity of litter found in several upland oak stands in eastern Tennessee ranged from 2 to 12 tons per acre. Fire, cutting practices and stand composition are factors that cause variations in the litter layer. On one mixed oak stand annual leaf fall added an average of 1.3 tons of litter to the forest floor. Total litter reached a peak of 5.4 tons in December following leaf fall and then decreased to a fairly stable low August weight of 4.2 tons.

The moisture content of hardwood litter, at field capacity, was found to average 135 percent of its oven-dry weight. Temporary detention of additional moisture immediately after a rain increased the amount up to 175 percent. Complete saturation of the litter in the laboratory gave moisture contents up to 250 percent. The normal moisture content of the litter depends primarily on the number of days since the last rain of 0.25 inch or more. Moisture content decreases rapidly to 41 percent after 10 days and then gradually to 25 percent at 20 days. Here it becomes relatively stable subject to minor fluctuations due to relative humidity.

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Classifying Southwestern Watersheds on the Basis of Water Yields

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IN THE SOUTHWEST the natural flow of streams is too uncertain to be depended upon for irrigation, industrial, and domestic use. To conserve water and use it effectively during periods of deficient streamflow, large reservoirs have been built and considerable investment made to insure maximum use of erratic water supplies. Increased demand puts increasing stress on available supplies, consequently attention has turned to the water-yielding areas and ways to recognize or classify them in terms of the water they produce.

Streamflow Measurements

Water is an important watershed product which has been measured at gaging stations above points of use for many years. These measurements have been used to determine size of reservoirs, the design and amount of land to be developed for irrigation projects, and other factors connected with the amount and availability of water for industrial and domestic uses. The importance of these measurements cannot be denied nor is there a suitable substitute. They do have definite limitations, however, especially for determining where water yields may be improved through watershed management.

Stations for measuring streamflow are maintained on most major streams but there are few areas where enough measuring stations are located on the upper portions of the smaller tributaries to study or determine the geographical distribution of the runoff. This becomes important when considering where and how water yields can be maintained or improved. When runoff is expressed in inches over a drainage basin it has value for comparisons of runoff and precipitation with other large watersheds, but fails to show those units of the watershed that are contributing the major portion of the water or the relative contributions from different sections.

In some smaller watersheds where detailed measurements are available it is possible to calculate the runoff from partial basins and to determine runoff relations from the different sections more adequately. When this is possible the runoff in inches for a particular unit of a drainage can be secured and some idea obtained of the areas contributing the water. Any large watershed is a complex made up of individual units each differing in soils, vegetation, geology, physiography and local climate. Measured streamflow from a large watershed gives only the integrated flow from the various watershed units, but does not indicate which units produce large or small water yields. Just as the timber manager needs to know which areas are capable of high timber production and justify intensive management for wood products, the watershed manager must locate those areas which will repay intensive management for water yields.

Southwestern Watersheds Highly Variable

Within watersheds of the Southwest, elevation, soil, direction of prevailing precipitation, and temperature, vary widely—more widely than in most any other section in the United States. The Gila River in Arizona and New Mexico, for example, enters the Colorado River at an elevation of less than 148 feet above sea level but rises on Mt. Baldy above 11,400 feet elevation. Rainfall varies from less than 4 inches annually at Yuma, Ariz., to over 35 inches measured in the higher mountain areas. Temperatures vary from an average annual of 73° at Yuma to 44° measured at Alpine, Ariz., and undoubtedly cooler at higher elevations where measurements are not available.

Seasonal distribution of precipitation and ratios of snow to rain vary greatly. Precipitation has two distinct sources. The Pacific Ocean is the source of most winter precipitation and the Gulf of Mexico the source of most summer precipitation. The percentage of winter and summer precipitation varies generally with the distance from the source of the moisture. In Arizona, for example, the western portion of the state receives most of its precipitation as winter moisture; less than 40 percent of the year's total falls during the summer growing season. The reverse is true in eastern New Mexico where some sections receive in excess of 80 percent of the year's total moisture during the summer season.

Streams are rain and snow fed. Snow falls at the higher elevations and generally some snow pack results. Moderating weather during the winter accompanied by heavy rains may produce sizable amounts of runoff and is an important source of water for reservoir storage.

These extremes in climate together with the physical conditions of the watersheds emphasize that time of water yields, rainfall distribution, and time of water use are factors which should be incorporated into the classification of lands which considers water returns.

Time of water yield related to precipitation distribution.—At the Sierra Ancha Experimental Watersheds located 40 miles north of Globe, Ariz., streamflow measurements from Parker Creek, a 700-acre watershed, make possible a comparison of the effectiveness of summer and winter rainfall as a source of runoff (Fig. 1).

The north-facing slopes are covered with ponderosa pine and the

[1]Maintained by the Forest Service, U. S. Dept. Agric., with headquarters at Ft. Collins, Colorado.

south-facing slopes with mixed grass and chaparral. Elevations range from 5,500 feet at the gaging station to 7,300 feet at the top of the watershed. Precipitation varies from 25 inches at the lower portions of the watershed to 30 inches near the top. Annual average temperatures range from about 59° to 45°F. over the years of record.

Little riparian vegetation occurs and there is no moisture carryover for perennial streams. Consequently, an excellent measure of effectiveness of summer and winter precipitation is obtained.

Annual rainfall can be and is related to annual runoff. In addition the rainfall-runoff year can be separated into the cool winter period and the hot summer period to determine the influence of the precipitation of each period on total runoff. Three factors make this possible:

1. Distinct periods of summer and winter precipitation. Most of the winter precipitation occurs during December, January, February, and March, and most of the summer precipitation in July and August. During the winter season storms are gentle and of several days' duration. Precipitation is a mixture of snow and rain. This contrasts with the summer period when storms are of short duration and frequently occur as heavy cloudbursts reaching intensities of 5 inches in 2 hours.

2. Periods of little or no precipitation occur between the summer and winter precipitation. Little if any precipitation falls during April, May, and June; therefore it is possible to separate the winter from the summer season. Also, the months of October and November, and in some years September, are dry months which makes it possible to separate the summer from the winter rainfall period.

3. Rapid drain-out of excess precipitation. This results in ephemeral streams so that it is possible to relate runoff to seasonal precipitation. Little or no evidence of surface runoff exists in the watershed. Streamflow results from an intermediate flow that infiltrates into the shallow soil mantle but drains out through root openings and rock contacts. Since the watershed is steep, the soils shallow, and the drain-out rapid, the resulting runoff from a particular storm or group of storms can be readily measured. This watershed yields a relatively large percent of the precipitation (24 percent) as streamflow.

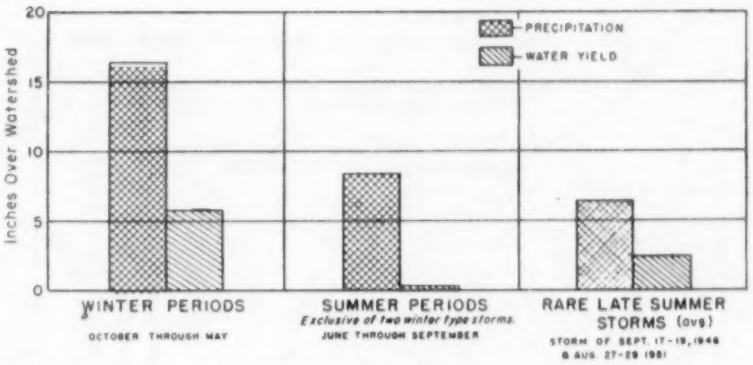

FIG. 1.—Relation of winter and summer precipitation to water yields from Parker Creek Watershed. 1934-1951.

During the winter period, October through May, the winter rainfall averages about 66 percent of the annual precipitation, but nearly 92 percent of the total streamflow results from winter precipitation. In contrast, summer rainfall averages 34 percent of the annual total and results in only 8 percent of the total streamflow. Two large quantity winter type storms have been recorded during the summer periods September 17-19, 1946 and August 27-29, 1951. These two storms were large enough to satisfy the soil moisture deficit over most of the watershed and contributed streamflow similar to that resulting from winter storms. The runoff from these two storms accounted for 82 percent of the total summer streamflow. Even with these two large quantity storms, the summer runoff was only 5.48 percent of the summer precipitation while the winter runoff averaged 33.85 percent of the winter precipitation. Thus summer rainfall, with the exception of the occasional large storm or the occasional high intensity thunderstorm contributes little water to streamflow.

Periods of water use by plants and loss by evaporation.—Periods of water use by various types of vegetation have been measured at the Sierra Ancha Experimental Watersheds. These data are summarized in Figure 2. The data are from different years, consequently some points do not coincide exactly because of variations between years. The precipitation curve represents the average for Sierra Ancha during the period 1934-50. The curve showing the water use by plants with optimum water supply covered one year only, 1936. The curve for water use by plants under natural rainfall conditions represents two years, 1938-9. These curves show the periods of water use as well as the periods of water surplus. The vegetation with only the natural precipitation used less water than the annual total because of the low use during the winter period. The vegetation with optimum moisture used more than the annual total, but use does not coincide with the rainfall curve. The winter period showed surplus water and the summer period a deficit. The relation of these curves to each other when considered in the light of use and supply points out the logic of dividing the year into two water periods: (1) when precipitation exceeds potential evapo-transpiration, there is surplus water available; and (2) when precipitation is less than potential evapotranspiration, a water deficit occurs. The conditions characterizing

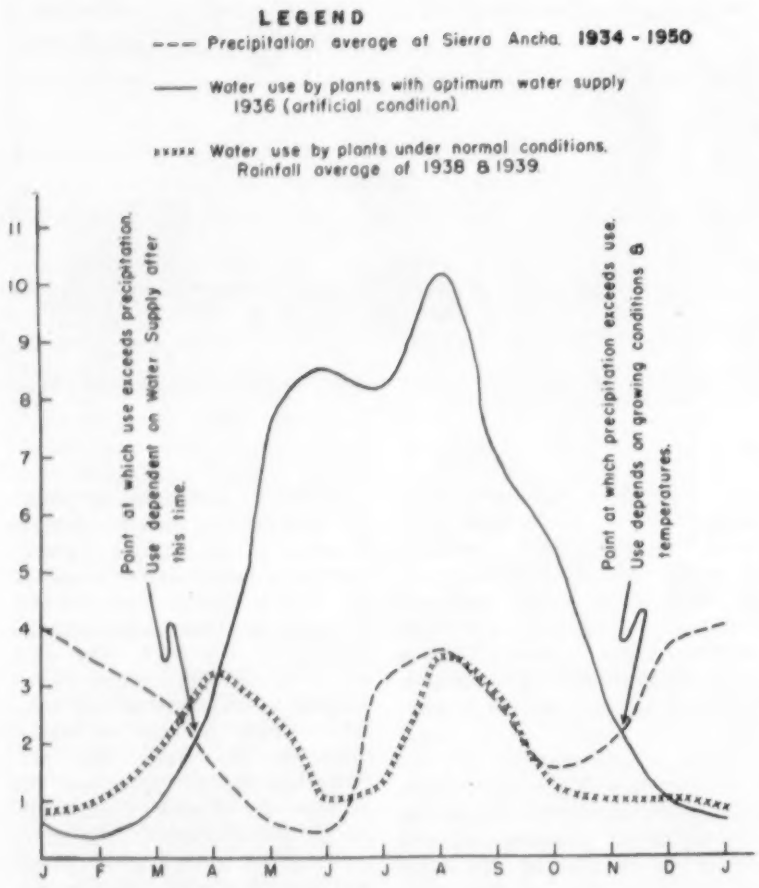
LEGEND
Precipitation average at Sierra Ancha. 1934 - 1950
Water use by plants with optimum water supply 1936 (artificial condition)
Water use by plants under normal conditions. Rainfall average of 1938 & 1939
Point at which use exceeds precipitation. Use dependent on Water Supply after this time.
Point at which precipitation exceeds use. Use depends on growing conditions & temperatures.
J F M A M J J A S O N D J

FIG. 2.—Comparison of periods of water use and precipitation.

these two periods explain why some water is available to streamflow and underground basins, even though the annual precipitation is less than potential evapo-transpiration. The uses by evapo-transpiration during the winter period are small because temperatures are low and most of the plants are dormant. As a result a water surplus is accumulated. In many other places in the Southwest rainfall exceeds evapo-transpiration during the winter period. The length of time depends on the amount of precipitation and corresponding temperatures. It is during this period that most of the water accumulates for streamflow.

Periods of water surplus and water deficiency are an index to water returns.—Many workers have attempted to establish relations between recorded precipitation and temperature and effective precipitation and temperature to develop an index for measuring effective moisture. Thornthwaite[2] developed a method of determining potential evapo-transpiration from existing precipitation and temperature records. Using this formula along with runoff measurements and data on the time of water use by vegetation provides a workable basis for classifying watersheds as to comparative water yield.

This classification is illustrated in Figure 3 by data from three stations which represent the water-yielding areas of the Sierra Ancha Experimental Watersheds. The stations represented are within 20 miles of each other. The low water yielding area is near the tension zone between the desert grasslands and chaparral types; the intermediate water yielding area is in the oak-woodland-chaparral type; and the high water yielding area is in the pine-fir forest type. The times of water use are similar at all locations, lowest in the winter and highest in the summer. Rainfall distribution is similar at all three locations.

As noted from Figure 3, there are four distinct periods: (1) water

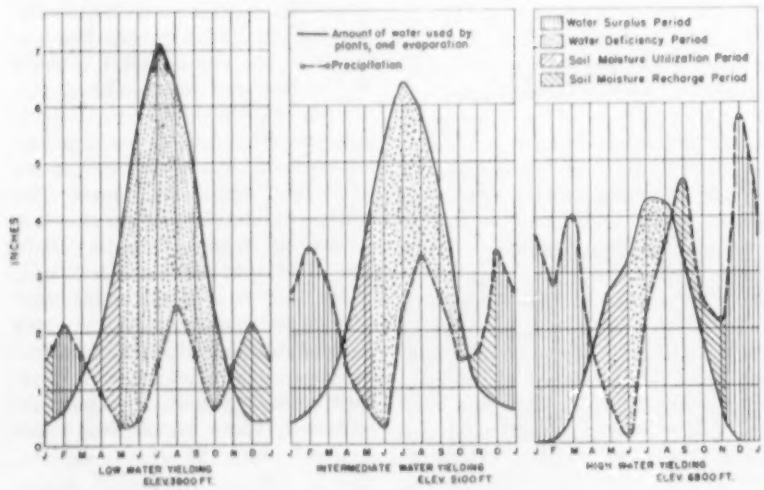
Amount of water used by plants, and evaporation
Precipitation
Water Surplus Period
Water Deficiency Period
Soil Moisture Utilization Period
Soil Moisture Recharge Period
INCHES
LOW WATER YIELDING ELEV 3800 FT.
INTERMEDIATE WATER YIELDING ELEV. 5100 FT.
HIGH WATER YIELDING ELEV 6800 FT.

FIG. 3.—Periods of water surplus and deficiency. Low, Intermediate and High Water-Yielding areas. Sierra Ancha Experimental Watershed.

[2]Thornthwaite, C. W. An approach toward a rational classification of climate. Geographical Review XXXVIII(1). 1948.

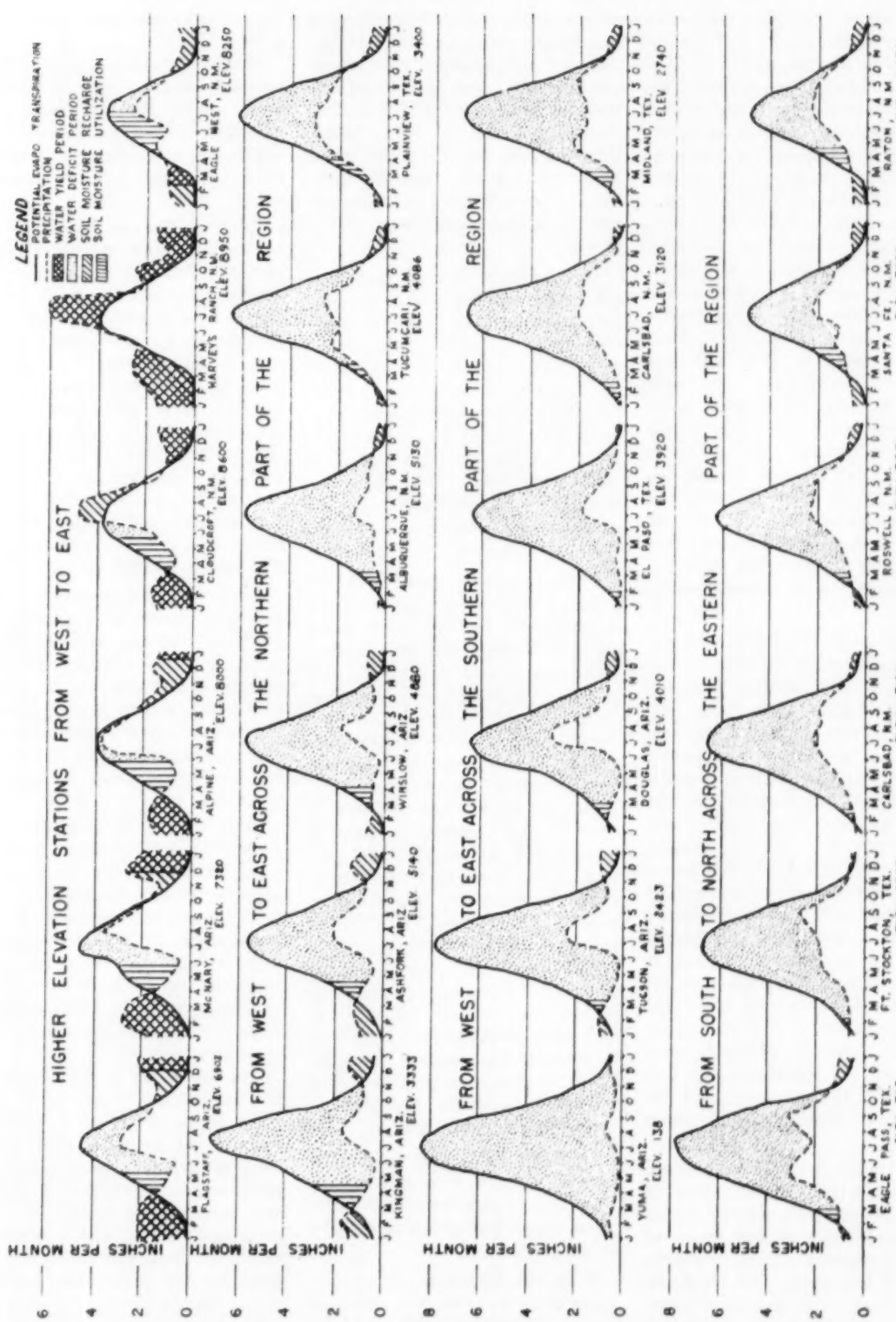
LEGEND
POTENTIAL EVAPO TRANSPIRATION
PRECIPITATION
WATER YIELD PERIOD
WATER DEFICIT PERIOD
SOIL MOISTURE RECHARGE
SOIL MOISTURE UTILIZATION
HIGHER ELEVATION STATIONS FROM WEST TO EAST
FROM WEST TO EAST ACROSS THE NORTHERN PART OF THE REGION
FROM WEST TO EAST ACROSS THE SOUTHERN PART OF THE REGION
FROM SOUTH TO NORTH ACROSS THE EASTERN PART OF THE REGION
INCHES PER MONTH
J F M A M J J A S O N D J
FLAGSTAFF, ARIZ. ELEV. 6903
McNARY, ARIZ ELEV. 7380
ALPINE, ARIZ ELEV. 8000
CLOUDCROFT, N.M. ELEV. 8600
MARVEL'S RANCH, N.M. ELEV. 8950
EAGLE NEST, N.M. ELEV. 8250
KINGMAN, ARIZ. ELEV. 3333
ASHFORK, ARIZ ELEV. 5140
WINSLOW, ARIZ ELEV. 4880
ALBUQUERQUE, N.M. ELEV. 5130
TUCUMCARI, N.M. ELEV. 4086
PLAINVIEW, TEX. ELEV. 3400
YUMA, ARIZ. ELEV. 138
TUCSON, ARIZ. ELEV. 2423
DOUGLAS, ARIZ. ELEV. 4010
EL PASO, TEX. ELEV. 3920
CARLSBAD, N.M. ELEV. 3120
MIDLAND, TEX. ELEV. 2740
EAGLE PASS, TEX. ELEV. 743
FT. STOCKTON, TEX. ELEV. 2925
CARLSBAD, N.M. ELEV. 3120
ROSWELL, N.M. ELEV. 3571
SANTA FE, N.M. ELEV. 7000
RATON, N.M. ELEV. 6676

FIG. 4.—Water-yielding and water-deficit periods in certain sections of the Southwest.

surplus, (2) water deficiency, (3) soil-moisture utilization and (4) soil-moisture recharge. Generally moisture stored in the soil during the winter surplus period is used before precipitation exceeds the high summer potential evapo-transpiration. Also, there is sufficient precipitation during the late winter months to recharge the soil reservoir after which additional winter precipitation may produce surplus water except at locations where the soil mantle is very deep. The potential use is highest at the lowest elevations and decreases with increased elevations. Total seasonal rainfall also increases with elevation so that increasingly larger amounts of surplus water are available for streamflow at the higher elevations. In all cases more rainfall occurs during the winter period than is used by evapo-transpiration, and in all cases the summer is characterized by a water deficit when potential evapo-transpiration exceeds precipitation.

Patterns of evapo-transpiration and precipitation throughout the Southwest.—To further illustrate this classification, data from individual weather stations have been plotted to show the relation between potential evapo-transpiration and precipitation from west to east across Arizona, New Mexico, and west Texas (Fig. 4). The weather stations used are located in towns and communities which are usually situated in valley areas. They are not exactly comparable because of different elevations and relations to mountain areas, nor do they reflect the lower temperatures and higher precipitation of the mountains. They do, however, illustrate some effects of (1) elevation, (2) latitude, and (3) the amount and distribution of precipitation on water yields.

The higher elevation stations are represented in the first line of graphs of the figure without regard to latitude; the second series of graphs represents the northern part of the area; the third series crosses the southern part; and the fourth series depicts relations from north to south from northern New Mexico into western Texas. These graphs illustrate the effects of both rainfall distribution and temperatures on water yields. As pointed out earlier, the stations are not comparable because of different elevations and different total quantities of annual precipitation. They do, however, illustrate the increase of ineffective summer moisture as far as water yields are concerned in the eastern part of the region.

In the western part of the region where the heaviest winter precipitation occurs, more water is available for streamflow than in the eastern part where the dominance of precipitation shifts from winter to summer. Here the higher precipitation is used by evapo-transpiration. The northern section is characterized by cooler temperatures and correspondingly less evapo-transpiration, with higher water returns.

Water-yielding areas can be grouped into three classes: high, intermediate, and low.—By using existing Weather Bureau temperature and precipitation data together with runoff and water-use information, it has been possible to draw a map of the Southwest classifying high, intermediate, and low water-yielding areas (Fig. 5). While the map is not intended to show the exact amount of runoff to be expected, it does present a pattern of the areas that have major water surpluses and those that contribute little water. The figure is based on average watershed conditions through the Southwest. It illustrates a concept: Some areas should produce high water yields and other areas cannot be expected to produce high water yields because of low precipitation, high soil moisture deficits, and high potential evapo-transpiration.

In nearly all areas examined water yields result from surplus water stored during the winter period when evapo-transpiration requirements are low.

With the exception of riparian areas along streams, wet meadows, and some limited areas at higher elevations, the watersheds of the Southwest seldom receive adequate moisture to supply the needs of evapo-transpiration throughout the year.

During the summer less precipitation is received than is required to supply the needs of evapo-transpiration. In contrast, precipitation during the winter period generally exceeds the uses by evapo-transpiration.

Areas on the eastern side of the region generally receive a large portion of the total precipitation during the summer period. Areas on the west receive most precipitation during the winter period. Because of the dominance of summer precipitation in the eastern part of the area much of the precipitation is used by evapo-transpiration. In the western part of the area the highest precipitation occurs during the winter period when evapo-transpiration uses are low with the result that a larger percentage is yielded as streamflow.

There would be no reason to consider the summer as a water yielding period of any appreciable importance in the Southwest because summer precipitation is seldom sufficient to satisfy potential evapo-transpiration at the high elevations and almost never sufficient in the intermediate and low water yielding zones.

High water yields cannot be expected from all parts of a watershed because of the precipitation distribution and its relation to potential evapo-transpiration. A close examination of the water yielding map along with the foregoing charts locates the high water yielding areas where intensive management for water yields has the best chance for success.

The low water yielding areas, on the other hand, contributed very little or no water to streamflow. Usually an actual deficit occurs even during the winter period because winter precipitation is often not sufficient to satisfy the soil moisture deficit, which must be satisfied before any water becomes available for streamflow. In these areas management may decrease evapo-transpiration uses, but the chances for increased water yields

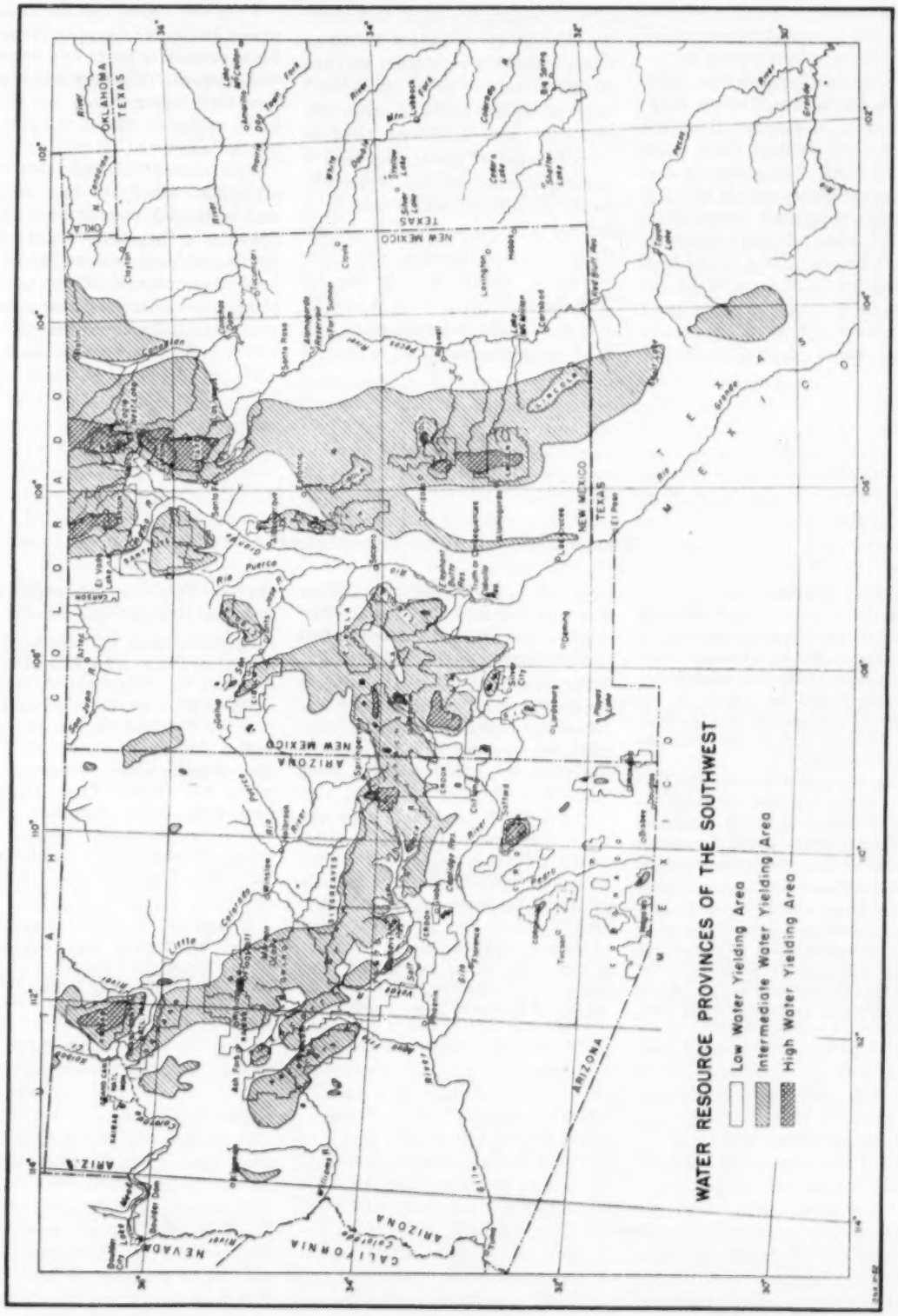

FIG. 5.—Water resource provinces of Region 3.

would be limited since part or all of the increased water would be required to satisfy the soil moisture deficit and evapo-transpiration needs. Instead of managing the intermediate and low water yielding lands for increased water it appears logical to manage them for the control of summer flood peaks and the reduction of sediment, and for other products which will not jeopardize watershed potentials.

On the basis of other measurements at Sierra Ancha watersheds flood potentials and sediment are factors that must be considered along with water yield. Generally the high water yielding areas are low sediment producing areas unless they are abused, because storm intensities are not great and there is sufficient precipitation to maintain an effective vegetation cover to control erosion. On the other hand the low water yielding areas are generally high sediment yielding areas because of the high intensity summer storms and the severe climatic conditions which create a delicate balance between the vegetation cover and erosion. Once this balance is disturbed or broken by drought or abuse or both it is difficult to reestablish a protective cover of vegetation sufficient to control erosion and sediment movement during high intensity storms.

Thus the logical use for summer precipitation is to supply the needs for a protective plant cover to control erosion. This should not interfere with water yields but should make optimum use of the summer precipitation.

This concept of watershed classification, based on precipitation and potential evapo-transpiration provides a practical approach to many problems encountered by watershed managers in determining the type of watershed management most logical for the different parts of southwestern watersheds.

Minnesota Forests Show Improvement

In spite of continuous cutting, Minnesota's timber stands have improved during the past 17 years, according to Station Paper No. 31, prepared jointly by the Lake States Experiment Station of the Forest Service, U. S. Department of Agriculture, and the Minnesota Office of Iron Range Resources and Rehabilitation.

During the period between the 1936 survey and the one just completed the volume of timber stands in Minnesota increased noticeably although volumes of softwood saw timber dropped 20 percent, hardwood saw timber volumes increased 51 percent. Volumes of softwood pulpwood are about the same as 17 years ago, but aspen pulpwood volumes are now about 50 percent greater.

Pole-timber and saw-timber stands have increased substantially in area, according to the report. The acreage of nonstocked land also has increased slightly, however, and softwood types have decreased somewhat in area.

The rate of timber cut increased since 1936. The cut of lumber and veneer logs rose 29 percent, and pulpwood and excelsior rose 146 percent. Fuelwood cut, on the other hand, dropped 17 percent.

The report indicates that more timber of some species could be harvested in Minnesota than was cut in 1952. Improved protection against fire and other factors has created a favorable balance of growth over volume cut. Most of the potential increased cut, however, is tamarack, cedar, aspen, and other low-quality hardwoods, rather than the preferred spruce or pine. Much of the available timber also is located in rather sparse or inaccessible stands.

Participating in the Minnesota forest survey were: The Minnesota Department of Conservation, the 16 northern counties, the Chippewa and Superior National Forests, Bureau of Indian Affairs, University of Minnesota, Blandin Paper Company, Minnesota and Ontario Paper Company, Northwest Paper Company, Wood Conversion Company, Office of Iron Range Resources and Rehabilitation, and Lake States Forest Experiment Station.

A copy of the report may be obtained by writing the Lake States Forest Experiment Station, U. S. Forest Service, University Farm, St. Paul 1, Minnesota.

Notes

Fourth World Forestry Congress

Almost fifty nations and four international organizations took part in the Fourth World Forestry Congress, December 11-22, 1954, in Dehra Dun. This was the greatest number of nations ever to participate in a world forestry congress.

The meetings were held in the buildings of the world-famous Indian Forest College and Forest Research Institute, where more than 350 delegates had gathered.

Because of the presence of a delegation from Red China, the U. S. State Department at the last moment ruled that the United States would refuse India's invitation to send an official representation. As a result of this belated action, the participation of U. S. foresters was in point of numbers a major disappointment. Twenty-three Americans had signified their intention of attending the Congress, but the decision of the State Department made the presence of federal foresters impossible, and only seven U. S. participants reached Dehra Dun.

So delayed was the State Department's decision that some U. S. foresters were already en route—one had reached Rome and one actually as far as Delhi—before word was received that federal men were not to participate.

Exhibits and motion pictures gathered from federal, state, and private sources, designed to show the Congress recent activities in American conservation were also withheld.

This puzzled historian does not feel competent to divine what major diplomatic victory may have been won by such an action, but he can assess its effect on the forestry profession: unqualifiedly bad. It was a rare opportunity lost to many of our leading foresters to contribute to the Congress and to derive the benefits of contact with men from other countries. It prevented the United States from bringing before this world assemblage some idea of the progress made in American forestry during the past five years since the Third World Forestry Congress, held in Finland in 1949.

But perhaps of even more importance from the long-range viewpoint is the unfortunate effect produced abroad. It introduced a political note in a meeting that was and should be purely scientific and professional; it gravely damaged the efforts that American foresters have been making for over a decade to bring forestry forward as one of the vehicles for creating more effective cooperation and solidarity among the nations; and finally, although not so intended, the refusal of the U. S. A. to accept India's invitation might well have been construed as a rebuff to the Indian Government.

The U. S. participants who finally reached Dehra Dun to face this bizarre situation were Ellen C. Dowling, Stanley G. Fontanna, with Mrs. Fontanna, Tom Gill, R. M. Lanner, R. L. Pugh, with Mrs. Pugh, Hardy L. Shirley, and Corydon Wagner.

Organization

The Congress was inaugurated at a plenary session by the President of India, and was addressed by the Union Minister of Agriculture, the Governor of Uttar Pradesh, and by the director of the Division of Forestry of the United Nations Food and Agriculture Organization, sponsor of the Congress.

Officers of the Congress, proposed by a Nominating Committee under the chairmanship of Tom Gill (U.S.A.) and approved at a plenary session, were as follows: Honorary Presidents, Panjabrao Deshmukh (India) and M. D. Chaturvedi (India); President, C. R. Ranganathan (India); Co-presidents, D. A. Macdonald (Canada) and V. N. Sukachev (U.S.S.R.); Honorary Co-president, Eino Saari (Finland); Vice Presidents, J. N. F. Carmelich (Argentina) *in absentia*, Liu Chang-tung (China), R. Jolain (France), H. Kittani (Iraq), D. Kennedy (New Zealand). M. D. Chaturvedi, organizer of the Congress, served as Secretary General, and officers of the Drafting Committee were Y. S. Ahmad (Pakistan), Chairman; H. G. Champion (UK), Co-chairman; and K. L. Aggarwal (India) Rapporteur General.

Deliberations of the Congress were organized under five sections, as follows: Section I, Present Status of Forest Protection and Forest Management in the World; Section II, Protective Functions of the Forest; Section III, Productive Functions of the Forest; Section IV, Forest Products Utilization; and Section V, Tropical Forestry.

In addition to these five sections, two important *ad hoc* committees were created, one covering Bibliography (Hardy L. Shirley, U.S.A., Chairman), and the other Higher Forestry Education (H. G. Champion, U. K., Chairman).

There were, in addition, *ad hoc* meetings of the International Union of Forest Research Organizations, the FAO Teak Subcommission, and the Empire Forestry Association. At the latter meeting Professor Champion announced that India had been chosen to receive the 1954 Sir William Schlich Award, and that C. R. Ranganathan, Inspector-General of the Indian Forest Service, had been given the award for presenting the best paper appearing during the year in the *Indian Forester*.

The *ad hoc* committee on Higher Forestry Education had a surprisingly high attendance. Seventy members participated, and in its deliberations prominent parts were taken by Deans Shirley and Fontanna. An important outcome of the work of this committee was the recommendation of the Congress that FAO adopt Dean Shirley's

plan to establish a continuing panel on education in forestry.

If FAO concurs, nominations for this panel will be sought from member governments. The panel itself will have responsibility of advising FAO in all forestry educational activities and of maintaining liaison among colleges of forestry and between FAO and colleges. It may also assist FAO in staffing technical missions. The panel would have the further responsibility of preparing agenda for discussions on education in forestry at world forestry congresses and at other appropriate international and regional gatherings of foresters.

The Fourth World Forestry Congress was the first to be held outside of Europe and the first to give particular emphasis to tropical forestry. Under this broad subject were discussed problems of utilization, methods of research and silviculture, methods of inventory, the menace of shifting cultivation, techniques of artificial regeneration, and the formation of plantations.

In addition to the discussions, delegates were given an opportunity to see results of management of tropical species, not only on the 1,000-acre grounds of the Forest Institute, but in nearby forests. Trips included visits to plantations, to stands of teak and sal, and to demonstrations of the taungya method of dealing with shifting cultivation. Pre-congress excursions in many parts of India gave additional chances for the study of many Indian forest types, as did a post-congress excursion to West Bengal.

Exhibits

Two large halls were built on the Institute grounds especially to house an exhibition of forest products of the various Indian States. Demonstrations of extraction equipment were part of this exhibit, which included specimens of plywood developed by the Institute itself. These exhibits were of interest not only to delegates but to Indian citizens, numbers of whom came in organized excursions.

The Russians and Chinese brought with them much more exhibit material than any other delegations. The Russians placed on display a large number of publications having to do with various forms of U.S.S.R. forest activity, and distributed to each delegate a book of articles by Russian forestry experts. These, unfortunately, were so badly translated into English that in many cases the meaning is lost. The Chinese confined themselves for the most part to large photographs with descriptive text in English, dealing with the various forestry activities now being carried on by the Chinese Republic.

Foresters attending the Congress owe no small debt of gratitude to Shri M. D. Chaturvedi, secretary-general of the Congress and its organizer. Every possible provision for the comfort of the delegates and for the effectiveness of the work had been taken care of by him. This was no small task, since it included the transportation, housing, and feeding of members, some of whom were lodged in quarters temporarily vacated by students of the Indian Forest College, and others in quarters of the nearby National Defense Academy. It was Mr. Chaturvedi who arranged for the forestry excursions. As an additional dividend, he provided many of the delegates with the thrill of an animal drive, in which the participants were transported by elephants to tree platform stations in the drive area. To the surprise of all, including Mr. Chaturvedi, one tiger was actually sighted.

A number of luncheons, teas, and entertainments were arranged, with such special features as snake charmers, trained bears, and traditional dances by one of India's most famous performers. The President of India received the delegates at a garden party in the grounds of the Institute on the opening day.

Congress Recommendations

The recommendations approved by the Congress are too voluminous for inclusion here, but a few may be summarized.

Touching on the protective role of forests, the Congress recommended further research on forest influences, particularly in catchment areas, to determine the influence of types of vegetation, treatment of the forests and grazing lands, and other factors on water supplies and on erosion.

Regarding the reclamation of degraded soils, including deserts, the Congress recommended that afforestation work be undertaken only after research into the methods and species to be used and on the prospective economic returns. It recommended the use of pilot plots to convince local inhabitants that such work is to their benefit, and thus obtain their cooperation. Especially in arid zones and deserts, it recommended that research into the use and role of trees in reclamation be carried on by FAO through setting up appropriate world or regional bodies to promote and coordinate such research.

Recognizing that education in the conservation of natural resources is essential at every stage, the Congress stressed the importance of creating demonstration plots, of extension work, encouragement of farm forestry, organization of conservation committees, and wide and intelligent propaganda. It emphasized the advisability of forestry students receiving instruction in agriculture, and of agricultural students receiving instruction in forestry, in order to facilitate much-needed cooperation.

The Congress called particular attention to the principles that no unused land should be left bare of vegetal cover, that every drop of water falling on the land should be used to the maximum benefit of the people, that land use should be conditioned by comprehensive planning based on land-use surveys, and that the peoples, particularly in rural communities, must early in life receive education in the principles of soil and water conservation, so that planning can be effectively implemented. In view of this need, it recommended that FAO, with the help of competent experts, undertake the preparation

of a set of "Principles of Soil and Water Conservation."

With regard to the productive functions of the forest, recommendations included the adoption of sound methods of classifying forest land, the use of superior strains obtained by selective breeding, and improved management of forest lands for grazing. Several resolutions were passed having to do with wildlife and with the management of forest land for recreation.

In the field of utilization, the Congress recommended a study of forest labor problems, improvement of tools and techniques used in forest operations and in the training of forest workers.

Tropical forestry, which received major attention, emphasized the need for intensifying research, particularly into ecological conditions, studies into the silvicultural characteristics of species, the treatment of stands, and the modifications brought about in the environment by various forms of silvicultural treatment. It was clear that experience acquired so far in tropical forests is in many cases insufficient for definite conclusions, either from an economic or technical point of view.

Future Congresses

Before the termination of the Congress, the principles and procedures to govern future meetings were considered, and a preparatory committee appointed to make preparations and select topics for the next World Congress. This committee is to be convened by FAO in Rome at the time of the FAO Conference which precedes by at least two years the date for the next World Forestry Congress. The year 1960 was suggested for the next Congress, and the French Delegation announced that France wished to be host. No final decision, however, will be made regarding either time or locale until the preparatory committee meets in Rome.

The proceedings, recommendations, and papers submitted to the Congress will, when printed, constitute an important addition to forestry literature. It is not yet known what distribution will be made of this material, but at least one copy will be on file in the office of the Society of American Foresters, where it will be available to those interested.

TOM GILL

Chairman, Committee on International Relations, Society of American Foresters

Machine Faster than Ax in Girdling

In a recent study on the Flat Top Experimental Forest near Birmingham, Alabama, machine girdling of unwanted hardwoods required only about half as many hours of labor as hand girdling with an ax.

The machine was a "Little Beaver" tree girdler. This is a 2-cycle gasoline-motored machine weighing approximately 35 pounds and carried on the operator's back. The cutting wheel is on the end of a flexible shaft.

Girdling time.—The machine was tested on about 3,140 trees, mostly oaks but including some hickory, blackgum, and other upland hardwood species. All were culls that had been left after a commercial stand improvement cut. They ranged in size from 5 to 25 inches in d.b.h. and averaged about 8 inches.

From the data, a formula was derived by regression analysis which predicts girdling time in man-hours from N (the number of trees girdled) and sum D (the sum of d.b.h.'s of trees girdled, in inches). The formula is: Man-hours = .003641 (sum D) — .008017 (N).

For the same area and type of timber, a formula for notch girdling with an ax has been found[1] to be: Man-hours = .006005 (sum D) — .010066 (N).

Both these production figures were obtained with a one-man crew, but one or more axmen can generally be used to good advantage in conjunction with the Little Beaver. They can treat hickories and trees too small for the power tool, and relieve the machine operator when he tires.

Provided that crews work with similar efficiency, the formulas might be applied to upland hardwood stands in other regions where not over 25 percent of the terrain is steep and the rest is moderately sloping to level. In either extremely rough or nearly level terrain, it would be well to check the constants given here against some that have been locally derived.

Simplified versions of the two formulas that are slightly less accurate are:

Man-hours for machine girdling = .0025 (sum D).

Man-hours for ax girdling = .005 (sum D).

If the average d.b.h. of the trees to be girdled is about 8 inches, these simplified formulas usually give estimates within 5 percent or less of the estimates obtained by the longer formulas.

At 30 cents a gallon for gasoline and 50 cents per quart for oil, operating cost of the Little Beaver was less than 30 cents per day. Since this was a new machine, there was no maintenance cost during the short time required for the test. Neither was there much indication of what the depreciation rate might be. Where wages are $1.00 per hour, however, the saving in labor over ax girdling would entirely depreciate the $180 cost of the machine in a little over 22 days.

Operation.—The girdler made a satisfactory cut that averaged about an inch wide. The depth could be varied somewhat by changing the angle at which the cutter guard was held and by increasing the pressure applied to it. On most trees only light pressure was needed. Occasionally a tree could not be satisfactorily girdled because seams of bark in catfaces extended inward too deeply to be severed and upward too high to be bypassed. If the catface did not extend too high, it was easiest to make the cut entirely above it. Some large chestnut oaks with unusually thick bark required extra cuts.

The girdler cut everything easi-

[1] Yocom, Herbert A. Estimating the time needed for girdling hardwoods. JOUR. FORESTRY 50: 484. 1952.

ly except hickory. It cut hickory satisfactorily while the blades were sharp, but the bark dulled the blades rather quickly. Once dull, the blades would hardly cut hickory at all and yet would continue to perform fairly well on other species.

The blades are disk-shaped and cut on one-half of their circumference at a time. When that half becomes dull they can be rotated and the other half used until it becomes dull. Then they must be removed and sharpened. A round ax stone that can be carried easily is good for this purpose. This test indicated that a good sharpening schedule was to use the blades one-fourth day, rotate them and use them the second quarter, and then sharpen them.

HERBERT A. YOCOM
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Gross Volume Estimation Using "Plotless Cruising" in Southeast Arkansas

During the forestry summer camp session at Arkansas A & M College in 1953, a field problem involving Grosenbaugh's "plotless" or "variable-plot" system of timber estimating was incorporated into the regular schedule of instruction in timber cruising.[1, 2]

For this study, we selected two 40 acre tracts of second growth, loblolly-shortleaf pine timber on which a 100 percent tally of all pine saw timber (9.6 in. d.b.h. and up) had been made for checking the accuracy of various line-plot and strip cruises. The two areas are referred to herein as "Forty A" and "Forty B" and are representative of second-growth timber conditions in Southeast Arkansas. This particular study was confined to the predominant pine saw timber, with lesser quantities of oak, gum, and miscellaneous hardwoods being disregarded. Gross pine volumes for these forties, based on the 100 percent tally, are given in Table 1.

Field Work and Basic Calculations

One-man parties performed the field work of plotless cruising. Four different students cruised each forty, two men running lines in a N-S direction, the other two running in an E-W direction. Five *sample points* were located on each of four lines through the area, making a total of 20 points per forty. A hand compass was used for line direction and the interval between sample points was determined by pacing.

The "critical angle" of 104.18 minutes was established by 33 inch cruiser sticks previously made by each student and provided with a 1 inch metal sight at one end. At each of the 20 sample points, all pines "in" (approximately 10 inches and up) and containing one or more merchantable 16 foot logs were tallied by log and half-log lengths. No diameters were recorded on this project. (Note: The detailed mechanics of plotless cruising will not be reviewed here except as they apply to the specific project in question. The reader is referred to Grosenbaugh's original articles.)[1, 2]

Volume-Basal Area Ratios

For best results, we worked out our own board-foot volume factors (ratio of the volume of each length class to basal area) for each half-log graduation from one to 3½ logs, this being the range of heights on the two sample forties. These volume factors can be rather easily calculated, especially if a local volume table has been constructed for the area to be cruised, since the average d.b.h. of each merchantable length (the principal factor which must be determined) can be reasonably approximated from the original curve of average merchantable height over d.b.h. class. Once this average d.b.h. has been determined for each merchantable length class, the average tree volume for each length class can be found in the local volume table. This average tree volume is then divided by the basal area to determine the volume factor or ratio for each length class.

Developing board-foot volumes per acre is quite simple at this point. The volume factor determined for each length class is multiplied by the number of trees tallied in that class, and the sum of all these products found. This "sum of products" is divided by the number of sampling points (20 in this case) and then multiplied by 10 (basal area factor) to derive the board-foot volume *per acre*. Gross volume on the tract is determined by multiplying by the timbered acreage. This was the procedure followed on this project, and the results are tabulated in Table 1.

Discussion of Results

As will be noted from the table, six of the eight separate estimates made by the plotless method were within approximately 10 percent of the correct volumes for the two areas, and all were within 20 percent of the 100 percent tally. To be sure, these results are far from astounding; yet they are much more accurate than previous estimates made by comparable line-plot and

TABLE 1.—COMPARISONS OF FOUR SEPARATE "PLOTLESS CRUISE" ESTIMATES WITH 100 PERCENT TALLY ON EACH OF TWO FORTY ACRE TRACTS OF SECOND-GROWTH PINE SAW TIMBER.

"Forty A"	Total pine volume: 52,912 bd. ft. (Doyle Rule)			
Line direction	N-S	N-S	E-W	E-W
Pine volume (b.f.)	51,844	48,380	61,616	57,303
% Error from 100%	—2.0%	—8.5%	+16.4%	+8.6%
"Forty B"	**Total pine volume: 76,570 bd. ft. (Doyle Rule)**			
Line direction	N-S	N-S	E-W	E-W
Pine volume (b.f.)	72,134	68,459	79,174	92,408
% Error from 100%	—5.8%	—10.6%	+3.2%	+20.0%

[1]Grosenbaugh, L. R. Plotless timber estimates—new, fast, easy. JOUR. FORESTRY 50: 32-37. 1952.

[2]———. Shortcuts for cruisers and scalers. Southern Forest Expt. Sta. Occasional Paper 126. 24 pp. 1952.

strip cruises of the area simply because the students did not incur their largest single source of error —the inaccurate estimation of plot radii and strip widths. This source of error is virtually eliminated by use of the sighting instrument in plotless timber estimating.

The experienced timber cruiser of course cannot justify the use of plotless estimates on the basis of the foregoing, since he may have little difficulty in correctly judging plot radii and strip widths. However, if his objective is *gross volume*, he may save considerable time by use of this newer system, especially if he develops applicable merchantable length-volume ratios and tallies by height classes only. We have found the method has some advantages in speed even when both tree diameters and height classes are recorded, probably because no time is lost in checking plot radii or strip widths, and that, generally, fewer trees will be tallied by using this method in lieu of comparable conventional estimates which sample a predetermined unit area. (The chances of tallying any tree are directly proportional to the basal area per acre of that d.b.h. class, and no trees are tallied which are more than 33 times their diameter from the sample-point.) Office calculations are more complex, of course, when diameters are recorded along with tree heights.

Limitations of the Method and Summary

In making timber estimates requiring data other than species, d.b.h., and height classes, as in preparation of management plans, plotless cruising losses most of its advantages in speed and simplicity. There are many situations where it might be cumbersome or not at all adaptable. On the other hand, where gross volume per acre or total volumes, by species, on a tract is the only information desired, we feel that the method works very well and is particularly advantageous to one man cruising alone.

It should have practical applications in farm forestry work, in stumpage appraisal work on small tracts where merchantable timber is being bought or sold, in making spot checks of residual volumes in stands following logging operations, and in other situations where quick estimates are desired on short notice.

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1954 Hurricane Damage on Penobscot Experiment Forest

The two hurricanes "Carol" and "Edna" that struck inland over New England this summer caused some timber losses. But the damage was neither so extensive nor so severe as the damage done by the hurricane of 1938 and the storms of 1950.

The full force of Hurricane Carol on August 31 was not felt in the eastern half of Maine. The storm center passed about 150 miles west of Bangor; but winds of 30 miles per hour velocity, with gusts up to 50, were recorded at Old Town. The winds were from the south and southeast. Rainfall that day was 1.09 inches.

However, the eye of Hurricane Edna passed about 50 miles southeast of Bangor. Winds of 40 miles per hour, with gusts up to 62, were recorded at Old Town. This time the winds came from the north and northeast. And in this storm 7.14 inches of rain were recorded at the Penobscot Experimental Forest (located about 8 miles northeast of Bangor).

Hurricane Carol caused some blow-down on the Experimental Forest, but the greater part of the damage was done by Hurricane Edna. Since the winds came from opposite directions in the two storms, some of the trees protected from one storm were exposed to the other. The drenching rain that preceded and accompained Edna saturated the soil and must have loosened the tree roots considerably.

A check of the damage was made on 177 permanent 1/5-acre sample plots on the Experimental Forest, in the area used for compartment-management studies. The stands here are softwood types, on low-lying land. The principal species are red and white spruce, balsam fir, and hemlock.

The check showed an average loss of about 1/4 cord per acre. The trees lost were in the 5-inch and larger class. They numbered less than 4 trees per acre.

Losses seemed to be related to species, site, and exposure. Some 70 percent of the trees lost to wind were balsam fir; these trees made up barely half of the volume lost. Spruce trees accounted for a fourth of the volume lost. The rest of the loss was in all other species. Many of the balsam fir trees had butt rot, and were broken by the wind. Losses were particularly heavy along roads, in openings in the forest, and on open edges of the forest.

The cutting practices tested in this area seemed to be closely related to the extent of wind damage. Stands where good and high-order cutting practices had been used suffered the lightest damage: 3.7 trees or 0.18 cord per acre. These compartments had been cut lightly (15 to 35 percent of the volume removed) and most of the poor-risk trees had already been take out. The growing stock was of good density, well spaced, and in good condition.

The heaviest losses—5.1 trees or 0.37 cord per acre—were in stands where fair and poor cutting practices had been tried. Here 50 to 90 percent of the volume had been removed with diameter-limit cuttings or clear-cuttings. The growing stock here was irregular and patchy, and in places very open.

Damage on uncut areas was 3.2 trees or 0.25 cord per acre. Although these stands had been undisturbed, they contained large, partially defective trees weakened by rot. Breakage of these trees contributed greatly to the rather large volume lost here.

T. J. GRISEZ
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Points of View

Technical Training and Foreign Needs

In connection with representing the Washington Section in the Washington Academy of Sciences, I have been much impressed with the vital need for greatly increasing technical education in this country so that we can continue to adequately compete with Russia in this field. Russia has been increasing technical education at an astonishingly rapid rate. It is feared that Russian technical personnel will soon satisfy the needs of such service in Russia and its satellites, and then Russian technicians will be spreading all over Africa, Asia, and other countries, far out-distancing our point-four and other technical personnel assistance work. Many authorities expect a stalemate on nuclear warfare because even now neither country could gain from a nuclear-weapon war. The real competition now of Russia is to gain by other means than war, and the vast number of technical trained graduates which she will have in a few years for work abroad cannot possibly be matched by our technical graduates at the present rate of production.

I think this is a matter which the proper authorities in the Society should give prompt additional consideration. In my opinion, and in the opinions of many others, one of the best ways to compete successfully with Communism in the more undeveloped parts of the world with a very low standard of living is to increase the living standard of these people. Their forests must be put under greatly improved management over what now exists as one means of helping to increase the standard of living of the individuals of these countries. A greatly increasing number of students and graduates from Central and South America and other areas should be brought to this country to be trained in forestry. I think that we need to produce at our forestry schools a greatly increased number of American graduates in forestry, particularly in tropical forestry.

The present administration is making special efforts to facilitate the investment of American capital in foreign countries which need development. Forestry in these undeveloped countries is a phase that is of vital importance in this program. To advise on and manage forestry investments abroad technical foresters with experience in foreign countries and speaking the languages are needed. Are the forestry schools in this country making plans to turn out these foresters for foreign work on a rapidly increasing scale?

At a dinner at the Cosmos Club last December 16 at which I represented the foresters, Dr. Carmichael, director of the Smithsonian and Dr. Sebrell, director of the National Institutes of Health, spoke briefly on the subject of need for more scientists. This dinner was followed by a public meeting in the auditorium at which Dr. Brock, president of the National Academy of Science, spoke on the same subject. Here we have three of the leading administrative scientists of this country stressing the need for greatly increasing our effort on science education.

The Science School Fair as developed here by the Washington Academy of Sciences and Science Service has been an outstanding success in interesting students in science, and is being followed up in other cities. I have reported to the Forestry Section on this subject. Each individual forester has the opportunity of interesting capable youngsters in natural science and by a little follow-up many of them will become foresters or specialists in related fields. No matter how much is done along these minor lines, there is need for the whole subject of science education to be reappraised by the proper authorities in view of the vast expansion of Russia along scientific lines.

G. F. GRAVATT
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Comments on "A Harvesting Technique for Beetle-killed Engelmann Spruce on the Western Slope of Colorado"[1]

Mr. Schaeffer has given approximate economic values for the spruce-fir forest type in Colorado in an attempt to show that "impaired watershed values, damage to the site, and damage to green trees resulting from salvage operations could lead to serious economic losses."

I am one of those who would question the procedures used by Mr. Schaeffer in evaluating the resources of that region. He has greatly exaggerated resource values by stating *gross* estimates without consideration of costs of production. Furthermore, he has lumped together five major classes of land-use without any attempt to define the limits of each within what he calls the spruce-fir type of Colorado. Since he reported on a harvesting technique for *commercial* forests, it would have been more appropriate for him to have confined his valuation to that class of forest.

Mr. Schaeffer assigned values to recreation, hunting, and fishing in the spruce-fir region of Colorado by dividing total expenditures by the total area. Similarly, he divided the *gross* income from grazing and a hypothetical income from water by total area to arrive at *values* per acre for these resources. Production costs were not considered and no attempt was made to arrive at the true worth of the land itself for these purposes.

[1]Schaeffer, Walter H. A harvesting technique for beetle-killed Engelmann spruce on the western slope of Colorado. JOUR. FORESTRY 52:860-62. 1954.

The method of determining timber value was not stated but, conventionally, it would be that of total timber production less the costs of producing it. Usually, foresters talk of present stumpage values and compare lands on the basis of *discounted probable net income* from forest crops that can be grown on them. It is not usual for foresters to value forest land on the basis of money spent for road building, manufacturing and logging equipment, recreation, etc.

Because of his extremely broad definition of forest type, Schaeffer has greatly diluted the value of merchantable forests within the spruce-fir region of Colorado. It is likely that the kind of forest for which his harvesting technique is proposed would produce a minimum of 100 f.b.m. per acre per year. Then each acre of land could be given gross annual values of about 80 cents in stumpage or $7.00 in lumber. If, as he implies, the commercial forest often contains more than 1,200 trees per acre, grazing values would be almost nonexistant. Hunting and fishing would not become valuable until logging opened the forest and made it accessible. Recreation values are likely to be extremely low within the commercial forests and *net* watershed values are surely lower than the $3.87 claimed for them.

Regardless of the actual figures assigned to various classes of land use, these values should represent the worth remaining with the land after costs of production have been met and should be stated specifically for each major zone of land use. It is quite unlikely that anyone buying commercial spruce-fir forest land in Colorado would be willing to pay $244.75 per acre which is the capitalized value at 4 percent of the annual "values" of $9.79 per acre for watershed, recreation, hunting and fishing, and grazing.

There is an urgent need for studies of land classification and land-use valuation. It is to be hoped that foresters will avoid exaggerated claims based on *gross* expenditures and will strive for general adoption of the principle of comparing land on the basis of *net* present worth.

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Comments on "Fifty Years of Chestnut Blight in America"[1]

I should like to correct two erroneous statements in the otherwise excellent article "Fifty Years of Chestnut Blight in America," that appeared in the May 1954 issue.

The authors stated on page 327: "Dr. Van Fleet also used native chinkapin and Japanese chestnut as one of his crosses, now known as S-8, which shows up well as a desirable forest-type tree." The hybrid S-8 has never reached the forests; it is a stubby, blight-deformed tree still standing in the federal chestnut orchard near Glenn Dale, Md. It has never been propagated vegetatively for planting as a forest-type tree. Only open-pollinated progeny of S-8 has been planted on forest sites. The original hybrid is surrounded by Chinese chestnuts and other miscellaneous hybrids, so that the open-pollinated and cross-fertilized progenies, for the most part, must be significantly different genetically than the parent hybrid.

On page 328 the authors stated: "Clapper's best cross (M-16 by American) is produced by crossing Chinese chestnut on an American sprout and backcrossing on Chinese chestnut. It has American form and Chinese resistance." My best cross is a selection of Chinese chestnut (M-16) crossed with an American sprout. This first-generation hybrid has form and fruit closely resembling that of the American chestnut. These hybrids, on the poor site at Glenn Dale, have blighted trunks, but the trees continue to live; some are 22 years old. I have made many back crosses of these hybrids to various types of Chinese chestnuts. Usually the back-cross-generation trees displayed resistance to the blight higher than that of the first-generation trees, and their form and fruit more nearly resembled that of the Chinese parent trees, not the American parent.

Two publications dealing with chestnut blight and breeding chestnuts have been issued since May: "Chestnut Blight and Resistant Chestnuts," (Farmers' Bul. No. 2068, U. S. Department of Agriculture, June 1954), and my "Chestnut Breeding, Techniques and Results," (Jour. Heredity 45(3): Part I, 107-114. May-June 1954; 45(4): Part II, 201-208. July-Aug. 1954).

RUSSELL B. CLAPPER
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We hope that all of your readers interested in forest chestnuts will note Mr. Russell B. Clapper's letter above with data on chestnut hybrids on which he has been working for many years. Also note the two publications he cites which have come out since our article appeared in the May 1954 JOURNAL.

R. KENT BEATTIE
JESSE D. DILLER

[1] Beattie, R. Kent, and Jesse D. Diller. Fifty years of chestnut blight in America. JOUR. FORESTRY 52: 323-29. 1954.

Reviews

Manual for Forest Fire Control: Fire Organization

260 pp. Illus. Joint publication of Northeastern Forest Fire Protection Commission, Chatham, N. Y., and Region 7 of the U. S. Forest Service. 1954. $1.50.

Out of disasters come object lessons which frequently arouse public action to prevent their recurrence. A good example was the 1947 Maine forest fire catastrophe and fires in other sections of New England and New York. Careful analysis revealed that the greatest weakness was the lack of trained leadership to handle large fires and coordinate overhead, manpower, and equipment.

The formation of the Northeastern Forest Fire Protection Commission was a direct outgrowth of these weaknesses. Its fourteen-article compact makes specific provisions for establishing better forest fire control among the New England States and New York.

A group of trained fire officers of the compact member states, in cooperation with the U. S. Forest Service, have prepared a forest fire organization reference manual. Undoubtedly, it is one of the greatest advances in forest fire control in the Northeast. Besides adoption by forest fire protective agencies, it may become standard curriculum in forestry schools in New England and possibly elsewhere.

This manual establishes the forest fire organization with a complete and detailed breakdown of the component parts, and an appendix of training, operational, and service data. Trainers and trainees are first introduced to this manual by an explanation of "Organizing the Fire Job." It is here that the framework of a fire organization begins to take shape. Top man is the fire boss, aided by three staff men—line boss, plans chief, and service chief. Each of these three key men maintains his own unit yet their functions are interrelated for the suppression job.

Twenty positions make up the full scale, large fire organization. Especially described is what each person is responsible for, his specific duties, and the delegated authority to execute assignments. The whole fire organization is built around the premise that one man can perform all the supervisory jobs when a fire is small, but as fires develop in size the situation requires delegation of jobs to other men building up to a large control organization.

The fire boss has full responsibility for prompt organization and supervision of resources available to him in the suppression effort. Upon him rests decisions of plan of action, techniques employed, and major changes to meet emergency situations.

The line boss is responsible for all action on the fire line. This primary job is to suppress the fire with the supervisory personnel, manpower, and equipment available. Serving under him are the line action men of sector bosses, sector specialists, crew bosses, and straw bosses.

The plans chief is second in command to the fire boss. He actually operates or manages the fire headquarters. Upon him rests the job of gathering all information pertinent to the fire and evaluating it for final decision by the fire boss. His staff is made up of an intelligence officer with scouts, map, and record and weather clerks; also a record officer with message center chief, and time record and fire log clerks.

The service chief is responsible for meeting the requirements of service and supply. Assisting him in this effort are motor equipment, communications, air operations, and supply officers and camp boss.

This section of the manual is concluded with a brief rundown on the operation of a fire organization and dispatching system.

The appendix contains helpful reference data and the ever useful tables and check lists. One important section is a helpful guide on techniques of instruction.

All forest fire control officers will find this manual a most useful reference guide. Its primary purpose is to show how a fire organization can be built up from a one-man fire and, as necessity requires, expand to a full-scale organization. Its adoption by each of the compact member states has provided for uniformity of large fire organization training.

AUSTIN H. WILKINS
Maine Forest Service

Hunting Whitetails

By Frank C. Edminster. 192 pp. Illus. William Morrow and Company, Inc. New York 16, N. Y. 1954. $3.75.

Foresters and outdoorsmen in general who love—and the few who abhor—the whitetailed deer will find Mr. Edminster's new and extremely readable book both entertaining and instructive.

Having just returned from a week of hunting whitetails in the Maine wilderness, I heartily subscribe to much of what Frank has to say on deer hunting fundamentals. It's good solid stuff for any sportsman who loves pursuing America's number one big game animal. It's good material too for foresters and woods workers, for the fundamentals of deer management are discussed here in no little detail, and by a man who is both an experienced hunter and biologist. Frank Edminster knows his big game well, having hunted deer for 25 years and in many states.

The book, as the author himself puts it, is designed to improve the hunter's chances of success in the less favorable covers as well as others. Under careful management—both the whitetail and the forest—the deer herds in most states have steadily risen and there is a need to better acquaint the hunters with the necessity of more and better harvesting.

Today the highest success ratio is in Texas—50 percent of the hunt-

ers getting their deer. Maine hovers around 40 percent and Michigan, Wisconsin, and Minnesita about 33⅓ percent. The average in what might be termed "good" deer country is 10 percent.

The author points out—and most other biologists will agree—that it is biologically sound to harvest from 20 to 25 percent of the herd. This would be good for the herd and good for the forest. A deer population that is in keeping with good forest management practices is something most game men and foresters seek although not always achieve. Edminster's discussion of deer management fundamentals should do much to bring these two professional workers together. And they need to be brought together if we are to make progress in the field of resource conservation in America. It's a three-way fight with the sportsman, biologist, and forester working toward the same ends—maximum wise use without waste or danger to existing and future supply.

There are six chapters in the book. The author describes his own first hunt and goes on to describe deer hunting methods in the second chapter. Three provides miscellaneous information on what to do after the deer is killed—dressing, transporting, care of trophy, and venison recipes. Four is a discussion of equipment for deer hunting and five facts about the whitetail. The final chapter covers deer hunting in America from Indian times to the present.

J. J. SHOMON
Virginia Commission of Game and Inland Fisheries

**Full Tree Logging—
A Challenge to Research**

By A. Koroleff. 101 pp. Illus. McGill University Bookstore, Montreal, P. Q. Canada. 1954. $3.50.

By "full tree logging" Koroleff means bringing the entire tree (stem, limbs, twigs, foliage and all) to the landing; and even, in some instances, to the mill. His interest in the possibilities of these practices was apparently whetted by data he found in reviewing Russian logging literature during the compilation of a previous book, *Logging Mechanization in the U.S.S.R.* The current book, somewhat of a sequel to the previous work, marshals testimony and opinions from an impressive number of people in the United States, Canada, and Europe on the various factors that might affect the practicability of full tree logging on the North American continent.

The contentions are that, where practicable, full tree logging offers possibilities for lowering logging costs; for reducing accidents to workers; for more complete utilization of the trees cut; and for reducing fire hazards and impediments to natural reproduction. Koroleff is particularly interested in the possibilities of applying this method of young softwood stands being cut in eastern Canada for pulpwood. He says 95 percent of such logging is now being done under some sort of a clearcutting system. Some attention is paid, however, to the possible application of this method to young hardwoods, and even to some types of selective cutting.

Several instances are cited where full tree logging has been tried in Germany, in the U. S., and in Canada. In most of these instances cable methods were used in the initial bunching, and tractor and arch combinations for transportation to the landing. In every case, it is claimed, the procedure appeared to promise lower logging costs, and the woods were left cleaner, more fire-safe, and in better shape for reseeding, than by other methods. Damage to advance reproduction in several instances was stated to be considerable, but by no means complete.

Information and opinions are quoted from a wide variety of authorities on the probable effect of this procedure on forest soil fertility (it is indicated that it would be minor); on the possibilities of economic use of branches, twigs, and even foliage; and on the potentialities for natural reseeding following the logging job.

Considerable space is given to discussion of the types of equipment that would be best suited to full tree logging. The necessity for directional felling is stressed. Standard methods of cable logging are reported to be well adapted to use with this practice, with less lost time and accidents due to the absence of slash, and fewer hangups particularly when the trees are skidded top first.

Tractor skidding methods are reported to be well adapted to this method also. Koroleff again bemoans the failure of American tractor manufacturers to put out a crawler skidding tractor with integral arch, in spite of general agreement that the all-in-one skidding machine is more maneuverable, safer, and probably cheaper than a tractor and arch combination. The possibilities of mechanical limbing at the landing are also discussed, together with possible methods of disposal of the material removed, perhaps for some useful purpose. Methods of bucking limbed tree lengths, of course, are already well developed, and the economies, particularly on integrated operations, well proved. There is also some data on the possibilities of hauling full trees to the mill.

All in all, Koroleff has provided us with an interesting and provocative book, that is well worth study and serious consideration by every forester, whether he is a logging engineer, a silviculturist, or is interested in utilization of the forest products.

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U. S. Forest Service

Plant Regulators in Agriculture

H. B. Tukey, editor. 269 pp. Illus. John Wiley & Sons, Inc., New York 16, N. Y. 1954. $5.50.

A natural successor to Avery and Johnson's *Hormones and Horticulture* and Mitchell and Marth's *Growth Regulators for Garden, Field and Orchard*, both published in 1947, the present volume consists of 16 chapters written by 17 experts under the general editorship of Dr. H. B. Tukey of the Michigan State College.

The first two chapters give necessary background on plant regulators—their history and nomenclature (still discussed in professional literature) — and a brief description of the anatomy of plants and the physiology of plant growth, just enough for a layman to understand later chapters. The third chapter explains the chemical nature of plant regulators and removes a great deal of mystery from the formidable scientific names of chemical compounds (such as 2,4-dichlorophenoxyacetic acid commonly known as 2,4-D).

The remaining chapters deal with the effects of growth regulators on plants, bringing the subject up to date. Each chapter explains the nature of a problem, discusses underlying principles briefly, and then gives directions for practical applications of growth regulators.

The topics discussed include rooting cuttings, control of flowering and fruit setting; parthenocarpy; abscission of leaves and defoliation; removing surplus blossoms (i.e., fruits) from trees and preventing drop of the remaining fruit (the same chemical substance is used in both operations); inducing and retarding the ripening of fruits, inhibition of sprouting in storage and in field (potatoes, onions, root crops); plant regulators in plant breeding ("certain difficult crosses have been made more easily"); weed control in lawns (everyone would like to read that!); weed control in orchard, field and nursery (foresters may be interested in this topic).

Chapter 15, "Plant regulators for vegetation control on non-crop land," will especially appeal to foresters confronted with keeping their stations, roadsides, telephone rights-of-way, or public campgrounds free of weeds. The last chapter describes equipment and methods for the application of plant regulators.

For research foresters the book will supply a great deal of thought-provoking information. They will be interested to know that "the voluminous literature on growth regulators and the rooting of cuttings furnishes (as yet) few clues as to the basic processes involved." Growth regulators do help in rooting of many species, but results with other plants (conifers for one) have been disappointing. "Hardwood cuttings of most forest trees . . ." can be rooted if taken from juvenile plants, "but when the plants have reached the adult stage (approximately 3 years or older), rooting has been obtained only in isolated instances." Probably some foresters will not agree with this statement.

There is much useful information in the book for the new profession of tree breeding. A search for natural growth substances found in pollen grains is urged. Induction and inhibition of flowering offer "intriguing possibilities" for seed production of forest trees. Abscission of flowers and young fruits (or conifer conelets) before and after pollination apparently can be prevented by spraying at appropriate times (to be determined for each forest tree species) with proper concentrations of 2,4-D.

Using plant regulators to overcome incompatibilities or get more hybrid seed in tree breeding appears to be only beginning. The book gives a few encouraging examples of such use in breeding other plants.

It would have been desirable to include in this book some discussion of possible toxic effects of the plant regulators on animals and especially on man. Although 2,4-D is not poisonous to animals, many other plant regulators are potent, physiologically active substances and should be handled very carefully. If these substances are not harmful to man, is should be so stated. Only in one place is it mentioned that "some regulators are toxic to man and other animals, and some may corrode equipment." Instructions for cleaning contaminated equipment that is, thorough washing, may be as well applied to the operator and his clothes.

As a whole, both research men and administrative foresters will find this easily read book very interesting and extremely useful.

N. T. MIROV
California Forest and Range Experiment Station

Soil

By G. V. Jacks. 221 pp. Illus. Philosophical Library, Inc. New York. 1954. $5.

This book is intended to give the farmer, the student of agriculture, and all who realize the importance of crop production an insight into the new knowledge of soil management, a knowledge which has been largely discovered in the course of the last fifty years and which embraces physics, chemistry, and biology of the soil.

"My aim," states the author, "has been to place before the reader the latest findings on each aspect of the subject in as simple a manner as possible without diverging too far from the strict principles of scientific orthodoxy." This task is accomplished in thirteen chapters covering definition of soil, architecture of the soil profile, soil chemistry, water relations, macro- and micro-population, humus, cultivation of soils, plant-made and man-made soils, soil classification, soil erosion, and the history of British soils.

Unlike so many other writers on soils, Dr. Jacks does not fail to give attention to soils of forests. He devotes a special chapter to this subject and many other sections of his book are permeated with the aroma of woodlands.

He particularly stresses the oft neglected role of the organic layers of forest soils and the importance of microbiological processes: "I have seen a pine forest in which recently pruned branches cover the ground loosely to a depth of three feet or more; in an adjoining section similarly pruned five years before, although nothing had been removed, there was scarcely a trace of the prunings to be seen. Everything had been decomposed, and the forester who had lived among such things all his life naturally saw nothing remarkable in them.

Yet it is inconceivable that if those tree branches (some several inches thick) had been spread in an open field they would have disappeared so completely. The forest fauna and microflora, however, dealt with them without difficulty.

Contemporary writings on soils include many books remarkable for their thoroughness, originality of subject matter, or value for agriculture. Most of these, however, possess one common peculiarity; they are difficult to read, especially for a person not initiated into the mysteries of soil science. In a large measure this is because of artificial, pedagogical terminology. No one can paint a colorful picture of the soil with the dilute gel-free tempera of planosols, grumosols, regosols, lithosols, and latosols. And no one can be inspired by the Greek-Latin-Russian concoctions which describe soils of the picturesque Wisconsin 'goat prairies' in terms of 'regosolic brunozems.'

Jacks has written a treatise of merit because he has the ability and the courage to call things by their proper and simple names. His book is interesting and thought provoking. The warm glow of humor, brightening many of its pages, is a gratifying experience, rare in the literature dealing with the dark and cold realm below the ground line.

S. A. WILDE
University of Wisconsin

Timber in Your Life

By Arthur H. Carhart. 317 pp. J. B. Lippincott Company, Philadelphia, Pa. 1955. $4.

No technical forester wrote this book. Probably no forest technician could have written it.

Carhart is not a technically trained forester. Nevertheless, he is a good practical man in the woods and has a remarkable grasp of the principles of sound forest land management.

With his insatiable desire to pry into the whys and wherefores of everything dealing with natural resources and their management Carhart hangs on to a subject and never lets go until he has exhausted all available source material. Now he tells the world about it by writing a book that reads like a novel and yet plumbs the depths of resource management and its relationship to wise land use.

He gives an accurate account of the U. S. Forest Service from its beginnings in the forest reserves down to the complicated multiple use management of today. He tells of forest fires, storms, and hard everyday work, and also tells of the land grabs, mining claim abuses, and the other political and selfish things.

His story of American forests and forest depletion begins with the settlement of this country down to the current situation in the Pacific Northwest. He sketches the history of the lumbering industry with its early record of reckless cutting and logging wastes, and its turn in recent times towards better utilization, sustained yield management, and tree farms.

Into his treatment of forests and lumbering he brings the story of research and its amazing contributions to timber growing and to the development of new and better forest products. He covers forest fires and fire damage in graphic terms and then he tells of forest insects and tree diseases and the enormous but less spectacular toll they take of forest resources.

Carhart gives an unusually clear picture of the public value of forests as watersheds and writes vividly of floods and soil erosion. As the author of *Water or Your Life* he is eminently qualified to discuss these things.

The importance of forests as reservoirs of wildlife and as places for human recreation are emphasized with much interesting and impressive statistical information. The figures on hunting and fishing in terms of money expenditures are startling.

Dwelling at length on the numerous ways in which timber and its products enter into human lives, he brings out many little known and interesting facts which will probably be entirely new to numerous readers. The book is replete with statistical information that is well handled, distributed in appropriate places, and does not make tedious reading. Personal anecdotes and short digressions from the main topic give the book an informal, chatty style.

After reading the book through twice I still do not see how Carhart covered so wide a field so completely and in such few pages. Anyone who reads the book thoughtfully and absorbs the factual information is going to have a fair working understanding of forests, watersheds, and timberland management. More than this he is going to have an idea of proper land use, land use as it applies to wildlands, and its importance to the future welfare of this country.

This book should be required reading for everyone who teaches conservation in our schools and for every member of the Congress. It is the best thing of its kind I have yet seen.

JOHN W. SPENCER
Santa Rosa, Calif.

Vegetable Tanning Materials

By F. N. Howes. 325 pp. Illus. Chronica Botanica Co., Waltham, Mass. 1953. $5.50.

This book reviews briefly the nature of tannins, their distribution, occurence, and function in the plant kingdom. A short history is given of the early uses of tannin materials. Present-day uses of tannin materials and the general methods of extraction and tannin extract manufacture are covered.

Major emphasis is on the sources of the principal vegetable tannins used throughout the world. A worldwide survey of all plants rich in tannins, including some 800 different species, is presented in a special section. The local practices followed in separating and concentrating the tannins from many important plant sources are described in detail.

These major tannins are classified according to the part of the plants

from which they are obtained; barks, woods, fruits, leaves, roots, and galls. The author demonstrates a great personal knowledge in his descriptions of practices in both tannin collection and use.

Foresters will be interested in information on certain tannins as important short-rotation crops. For example, black wattle (*Acacia mollissima*) is stated to be grown successfully as a short-rotation forest crop on over half a million acres in South Africa. Tannins are the major product and in good areas plantations have shown profits in excess of 4 pounds (approximately $11.20) per acre per year including planting costs.

This book will prove useful to individuals or groups interested in considering tannins as a potential forest crop byproduct. Information is presented on sumac, mangrove, various tree barks, and other possible tannin sources in the United States.

Considerable information is available on the distribution of tannins in various plant parts, particularly in woody tissues. In the opinion of this reviewer, the usefulness of the text would be enhanced by additional information on the chemistry of the tannins and their laboratory methods of analysis.

The book contains much useful information on vegetable tannins and is recommended reading for those with major interests in economic botany and extraneous wood components, as well as those specifically concerned with tannins and their uses.

ROBERT A. ZABEL
College of Forestry, State University of New York, Syracuse

Elements of Ecology

By George L. Clarke. 534 pp. Illus. John Wiley and Sons, Inc., New York, N. Y., 1954. $7.50.

The author of this interesting text is an outstanding limnologist and marine biologist at the Woods Hole Oceanographic Institution. The purpose of the book is to present the general principles governing the interrelationships between animals and plants rather than emphasize either "plant ecology" or "animal ecology." However, the emphasis is definitely on the marine environment rather than the atmospheric; and on animal ecology more than on plant ecology. In fact, the author usually refers the reader to the better known texts of plant ecology for more complete information whenever the discussion strays from the water environment.

The student will find the author's style stimulating and readable. He will also find the many examples of ecological relationships taken from aquatic habitats are easily understood—often, perhaps, more easily than similar relationships among terrestrial plants.

It appears to this reviewer that some phases of the atmospheric medium are inadequately covered. For example, rainfall is briefly discussed in four paragraphs (plus two illustrations) but snow, hail, and other forms of condensed moisture are not discussed.

Foresters are likely to be puzzled by the author's condemnation of clearcutting as a silvicultural method especially since he illustrates the evil effects by a photograph of a clearcut spruce-fir forest which has obviously burned over resulting in gully erosion. In another of the few references to forest management the author states, ". . . we do not know how to treat forest land to maintain its productive capacity." This should certainly give silviculturists food for thought.

Although there are a few errors most of them are "editorial" and do not affect the author's presentation. However, one which is likely to be confusing is the synonymous use of permanent wilting percentage and wilting coefficient. In the last chapter predation and competition are taken up. From the author's discussion based almost completely on examples from animal life there appears to be little difference between the two. It would seem that here would be an excellent opportunity to illustrate competition by examples from the plant world.

This book should prove to be a worthwhile addition to the library of the wildland manager who is primarily interested in wildlife management, especially fish management.

CHARLES W. BARNEY
Colorado A & M College

Publications of Interest

The third edition of the *Forest Farmer Manual*, "dedicated to the southern timberland owner—and more particularly the small owner," is published by the Forest Farmers Association Cooperative, 66 11th St. N.E., Atlanta, Ga. Edited by J. Walter Myers, Jr., this guidebook for timberland owners contains a wealth of information.

* * *

Desirable Cutting Practices for North Carolina Forests is published by the N. C. Forestry Association, Raleigh. The 22-page bulletin suggests broad principles and tentative desirable cutting practices for the major forest types of the state.

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Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

General and Liberal Educational Content of Professional Curricula: Forestry. By J. B. Sanders. 12 pp. U. S. Dept. of Health, Educ., and Welfare, Washington 25, D. C. 1954. Pamphlet No. 115. 15 cents (Govt. Print. Off.)

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Forest Management

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Society Affairs

Officers and Members of the Council, 1954-1955

E. L. Demmon, *President*
Southeastern Forest Experiment Station
Federal Building
Asheville, N. C.

William J. Brown
Woodlands Department
Kimberly-Clark Corporation
Neenah, Wis.

C. Huxley Coulter
Florida Forest Service
Tallahassee, Fla.

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Stanley G. Fontanna
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

Percy D. Hanson
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Missoula, Mont.

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Henry Clepper, *Executive Secretary*
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College of Forestry
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U. S. Forest Service
729 N.E. Oregon Street
Portland 8, Ore.

Ruthford H. Westveld
Department of Forestry
University of Missouri
Columbia, Mo.

School Box Score
Membership, 1955 Fiscal Year

School	Student applications received: Mar. 1955	Total 1954 fiscal year	Total 1955 fiscal year
Alabama Polytechnic Inst.	0	7	18
University of California	0	21	15
Colorado A & M College	1	18	3
Duke University	0	12	1
University of Florida	0	16	2
University of Georgia	0	38	14
University of Idaho	0	29	1
Iowa State College	3	32	8
Louisiana Polytechnic Inst.	0	0	0
Louisiana State University	1	14	14
University of Maine	6	16	13
University of Massachusetts	1	16	7
Michigan State College	3	25	31
University of Michigan	4	22	12
University of Minnesota	1	21	7
University of Missouri	1	20	8
Montana State University	0	19	10
State University of N. Y.	1	23	17
North Carolina State College	0	19	20
Oregon State College	3	17	8
Pennsylvania State Univ.	3	33	31
Purdue University	0	19	24
Utah State Agricultural Coll.	0	8	7
University of Washington	10	28	26
West Virginia University	0	21	5
Yale University	0	3	15
Totals	38	497	317

Section Box Score
Membership, 1955 Fiscal Year

Section	Applications received[1]: Mar. 1955	Total 1954 fiscal year	Total 1955 fiscal year
Allegheny	4	68	38
Appalachian	0	48	25
Central Rocky Mountain	1	26	4
Central States	8	80	68
Columbia River	6	56	18
Gulf States	11	57	36
Inland Empire	0	39	2
Intermountain	1	14	9
Kentucky-Tennessee	1	5	1
New England	8	54	39
New York	2	40	21
Northern California	3	34	22
Northern Rocky Mountain	5	35	15
Ozark	2	49	16
Puget Sound	14	61	33
Southeastern	2	128	44
Southern California	0	2	3
Southwestern	1	7	2
Upper-Mississippi Valley	5	64	18
Washington	1	7	2
Wisconsin-Michigan	1	11	7
Totals	76	885	423

[1]Student, Junior, Affiliate, Associate (Initial) grades only.

Coming Events

Southern Forestry Conference

The Forest Farmers Association, March 3-4, at the Edgewater Gulf Hotel, Biloxi, Miss.

New England Section

Annual meeting, March 10-11, Somerset Hotel, Boston.

20th North American Wildlife Conference

The North American Wildlife Conference will hold its 20th meeting March 14-16 in Montreal, Canada. Theme of the meeting will be "Natural Resources Use—A Continental Challenge."

Gulf States Section

The annual meeting of the Gulf States Section will be held at the Buena Vista Hotel, Biloxi, Miss., May 26 and 27.

The President's Column

E. L. DEMMON

THIS IS SOCIETY ELECTION YEAR. To be chosen are a President, Vice President, and nine Council members, each for a term of two years (1956-1957). A Nominating Committee has been appointed to make certain that we have the minimum number of candidates required for each office. Actually, it has been many years since a Nominating Committee has functioned in this respect, but we want to play safe again this year.

At least two candidates are required for President (who are also automatically candidates for Vice President), and at least nine candidates for the Council, each of whom must be a Society Member or Fellow. For the last few elections there have been several more candidates for each office than the minimum required. This is commendable and indicates the right kind of interest among the membership in the democratic selection of officers. Officers and Council members may be renominated, and there are certain advantages in having a few of these officers continue to serve for more than one term. As mentioned in a previous column, I will not be a candidate for reelection.

Nominations may be made by petition, which must be signed by at least 10 eligible members. A member may not sign more than one nominating petition for President nor more than one nominating petition for Council member. No person will be listed as a nominee for any office without his written consent.

Nominations may be made until October 1, 1955. Every eligible voter will have an opportunity to ballot on all candidates for office during October and November; the ballots will be counted on December 3, 1955. As for the past several elections, the well-tested Hare system of proportional representation will be used.

Nominations will also be open this year for the grade of Fellow. The Constitution says: "Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election." Election to the grade of Fellow is the highest honor that the Society can bestow on a Member. I prize this honor, which came to me in 1951, more highly than having been elected to serve as your President. The Society now has 69 Fellows, out of a total membership exceeding 10,000.

Nominations for Fellow must be signed by at least 25 Members or Fellows and submitted to Washington before October 1, 1955. It was fully demonstrated before 1939 that election to the grade of Fellow was practically impossible when left to a vote of the entire membership. In some years, no Fellows at all were elected, although many were nominated. It seemed best, therefore, to change the method of electing Fellows, by having as a board of electors those who are probably most familiar with the qualifications of the nominees, namely the current Society officers and Fellows. To be elected Fellow, a nominee must receive not less

A COMPARISON OF SOCIETY INCOME AND EXPENSE FOR 1953 AND 1954

	1953	1954
	Income	
Dues	$ 82,488.98	$ 86,846.91
Fee	1,985.82	1,941.85
Subscriptions & sale of jrls.	8,874.48	9,835.72
Advertising	22,916.79	23,656.66
Interest & dividends	576.88	591.95
Miscellaneous income	915.33	2,441.34
Total	$117,758.28	$125,314.43
	Expense	
Journal of Forestry	$ 38,167.92	$ 39,779.29
Editor's expense	443.45	301.53
Salaries, editorial	9,868.40	10,044.44
Salary, executive secretary	9,400.00	9,700.00
Salaries, office	27,470.08	27,679.50
Advertising commission	9,065.20	7,964.18
Advertising promotion & expense	2,739.81	2,940.41
Travel, officers	2,768.69	2,978.42
Postage	1,818.24	2,232.80
Telephone & telegram	693.93	617.24
Rent	3,528.00	5,856.75
Mimeograph & multigraph	376.75	509.75
Miscellaneous printing	784.45	1,181.00
Office supplies	1,150.37	1,370.17
General expense	1,367.28	1,393.40
Depreciation	494.69	900.22
Retirement plan	1,363.29	1,471.57
Retirement plan, reserve	—	640.00
Affiliation dues	260.00	250.00
Committee expense	15.60	55.30
Grading forestry schools	366.50	390.18
Council travel expense	1,205.49	1,038.05
Division expense	19.85	2.00
Social Security tax	575.82	799.01
Section manual	126.30	31.59
Miscellaneous	74.12	189.59
Referendum	379.21	—
Election of officers & fellows	527.84	—
Constitution & bylaws	518.65	—
Total	$115,569.93	$120,316.39
Net earnings	$ 2,188.35	$ 4,998.04

than half the votes of all those voting. For example, if 25 members were nominated for the grade of Fellow and 60 ballots were cast, and 10 of the candidates received 30 or more votes, those 10 would be declared elected.

Some members have not been entirely satisfied with this procedure, feeling that it is not truly democratic. Others have felt that nominees who were not elected to Fellow grade might consider it a sort of stigma or blackball. Actually, a Member should consider it a high honor to be nominated for Fellow, even though not elected. It is possible that the biographical sketches recounting the nominees' professional accomplishments have not always been adequately prepared by the nominators. It is very important, therefore, that these sketches be entirely factual, complete, and well prepared.

It has seemed to me that the current method of electing Fellows will never satisfy everyone, but I have not been able to come up with an idea for a better system. Certainly the old method of electing Fellows by the entire membership did not work. I would appreciate receiving constructive suggestions for changes in method of Fellow election if any members care to make them.

In the meantime, I hope all members will give serious thought to nominating the officers you would prefer to guide your Society during the next biennium, and also to nominating qualified candidates for Fellow.

E. L. Demmon

First Call for Council Nominations

All members are hereby notified that the regular biennial election will be held December 3, 1955. A president, vice president, and nine other members of the Council will be elected for the two-year term 1956-1957.

The present Council is listed in the box on page 217. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

President Demmon has announced that he will not be a candidate for reelection.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for over two decades. Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under which nominations are made by petition.

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TABLE 1.—DISTRIBUTION OF COUNCIL MEMBERS BY STATES DURING PERIOD 1940-1955

(Presidents' names are in capital letters; vice presidents', in italics)

State	1940-1941	1942-1943	1944-1945	1946-1947	1948-1949	1950-1951	1952-1953	1954-1955
Alabama		Smith, H. A.						
California	Krueger, M.	Baker, F. H.	Baker, F. H.	———	Nelson, DeWitt	Porter, Earl	Porter, Earl	
		Keen, F. P.	Keen, F. P.	———		Nelson, DeWitt	Thompson, P. A.	*Nelson, DeWitt*
Colorado	Peck, A. C.	Peck, A. C.	———	———	Spencer, J. W.	———	———	———
Connecticut	Hawley, R. C.	Hawley, R. C.	Hawley, R. C.	———	———	———	———	———
Dist. of Columbia	*Kotok, E. I.*	Behre, E. C.	———	———	McArdle, R. E.	McArdle, R. E.	McArdle, R. E.	———
Florida	———	———	———	———	———	———	———	Coulter, C. H.
Georgia	———	———	———	Evans, C. F.	*Evans, C. F.*	Evans, C. F.	———	———
Idaho	———	———	———	Evenden, J. C.	Evenden, J. C.	———	———	———
Illinois	———	———	———	Coffman, J. D.	———	———	———	———
Iowa	MacDonald, G. B.	———	———	———	———	———	———	———
Louisiana	Eldredge, I. F.	Eldredge, I. F.	———	———	———	———	———	———
Maine	———	———	———	———	———	Demeritt, D. B.	Demeritt, D. B.	Demeritt, D. B.
Michigan	Allen, S. W.	*Allen, S. W.*	*Allen, S. W.*	ALLEN, S. W.	———	Fontanna, S. G.	———	Fontanna, S. G.
Minnesota	———	SCHMITZ, H.	SCHMITZ, H.	———	———	Kaufert, F. H.	Kaufert, F. H.	———
Missouri	———	———	———	———	———	———	Westveld, R. H.	Westveld, R. H.
Montana	Gisborne, H.	Gisborne, H.	Smith, G.	———	———	———	———	Hanson, P. D.
New Hampshire	———	———	———	Herr, C. S.	Herr, C. S.	*Herr, C. S.*	———	———
New Mexico	———	———	———	———	———	Lindh, C. O.	Lindh, C. O.	———
New York	Howard, W. G.	Howard, W. G.	Recknagel, A. B.	Recknagel, A. B.	———	———	———	Illick, J. S.
North Carolina	KORSTIAN, C. F.	———	Damtoft, W. J.	Damtoft, W. J.	———	———	*Demmon, E. L.*	DEMMON, E. L.
Oregon	———	———	———	Dunn, P. M.	Dunn, P. M.	Brundage, F. H.	———	Stone, J. H.
Pennsylvania	McIntyre, A. C.	———	Shirley, H. L.	———	———	———	———	———
South Carolina	———	———	———	———	Flory, C. H.	———	———	———
Tennessee	———	———	———	———	Baker, W. M.	———	———	———
Washington	———	———	Greeley, W. B.	Greeley, W. B.	Greeley, W. B.	Marckworth, G.	DRAKE, G. L.	Heacox, E. F.
Wisconsin	———	———	Price, J. H.	*Martin, C. S.*	MARTIN, C. S.	———	Marckworth, G.	———
	———	———	———	Price, J. H.	———	———	Brown, W. J.	Brown, W. J.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office.

3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junior Members, Members, and Fellows in good standing.)

4. A voting member may not sign more than one nominating petition for President or more than one nominating petition for a member of the Council. That is, he may sign two, but no more.

5. Petitions must be in the Society office by October 1, 1955.

The Society has no special form for submitting nominating petitions. They may be written as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow) for the office of president (or member of the Council) for the two-year term 1956-1957.

All nominating petitions should be sent promptly to the Society office. The executive secretary will gladly provide information about nominating or election procedure.

According to the Constitution (Article VIII, Section 1) a Nominating Committee has been appointed by President Demmon. The Committee is composed of the following members:

Chairman, Adna R. Bond, Arnold, Maryland.

Randolph M. Brown, School of Forestry, University Farm, St. Paul 1, Minn.

Robert H. Clark, 209 West College, Fordyce, Ark.

Milo Deming, U. S. Bureau of Land Management, P. O. Box 659, Salt Lake City, Utah.

Edwin Loners, 3229 Alki Avenue, Seattle 6, Wash.

This committee is charged with the following duties:

1. To set the date of the election. (December 3, 1955 is the date.)

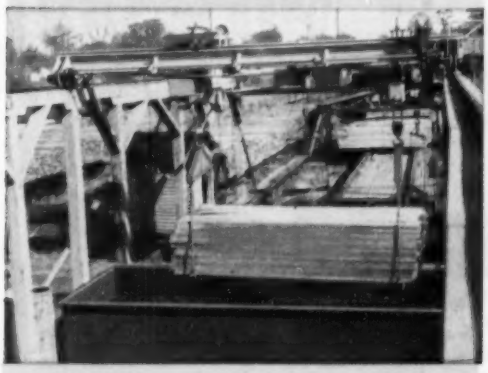
2. To provide for at least two candidates for the office of president, and at least nine candidates for membership on the Council.

3. To receive separate nominating petitions for the office of president and for each member of the Council, and to supplement such petitions when necessary with other nominations in order to comply with item 2 above.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting mem-

DIPPING—This photo shows a typical dipping vat located on the green chain. Overhead rollers force the freshly sawn lumber into the Permatox 10-S solution as it passes through the vat.

SPRAYING—Green timbers and large dimension can be sprayed by passing stock on a roller conveyor through a spray box fitted with nozzles or perforated pipes. (Cover removed.)



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bers should accordingly get busy and make their own nominations. For their information the distribution of Council members by states during the period 1940-1955 is shown in Table 1.

ADNA R. BOND, *Chairman,*
Nominating Committee.

First Call for Fellow Nominations

All Members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election, December 3, 1955.

As defined by the Constitution (Article III, Section 6), "Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election."

Nominations by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

We, the undersigned Members and Fellows of the Society of American Foresters, hereby nominate _____ for election to the grade of Fellow in 1955.

Remember these simple rules:

1. A petition may not name more than one candidate.

2. It must be signed by 25 Members or Fellows in good standing.

3. It should be accompanied by a factual, not eulogistic, biographical sketch of at least 200 words giving an account of the nominee's professional career and accomplishments.

4. It must be received in the executive office of the Society in Washington, D. C., not later than October 1, 1955.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing).

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows and the present Council. (A Council member who is also a Fellow has but one vote.)

The system is described in Article IV, Section 4 of the Constitution. To win election a candidate must receive an affirmative vote of not less than one-half the total votes cast.

Significance of the Grade

The highest membership distinction that can be conferred by the Society, this grade is awarded in recognition of outstanding achievement. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 100 Fellows elected. At the present time the number of living Fellows is 69.

Since the last election in December 1953, two Fellows have died: Elers Koch and E. A. Sterling.

List of Fellows

The current roster of Fellows follows. The state in which each Fellow is domiciled and the year of his election are shown after his name.

Allen, Shirley W. Michigan. 1948.

Baker, Frederick S. California. 1949.
Besley, Fred W. Maryland. 1940.
Brundage, Frederick H. Oregon. 1949.
Butler, Ovid. Maryland. 1940.

Carter, E. E. District of Columbia. 1942.
Chapman, Herman H. Connecticut. 1922.
Clapp, Earle H. District of Columbia. 1930.
Clepper, Henry E. Virginia. 1949.
Coffman, John D. California. 1946.
Cox, William T. Minnesota. 1953.
Curran, Hugh. Venezuela. 1951.

Damtoft, Walter J. North Carolina. 1951.
Dana, Samuel T. Michigan. 1935.
Demmon, Elwood L. North Carolina. 1951.
Drake, George L. Washington. 1953.

Eldredge, Inman F. Louisiana. 1942.
Evans, Charles F. Georgia. 1949.
Evenden, J. C. Idaho. 1953.

Ferguson, J. A. Pennsylvania. 1949.
Fischer, Arthur F. California. 1940.
Fritz, Emanuel. California. 1951.
Frothingham, E. H. California. 1942.

Garratt, George A. Connecticut. 1953.
Gill, Tom. District of Columbia. 1948.
Granger, Christopher M. Maryland. 1946.
Greeley, William B. Washington. 1918.
Guise, Cedric H. New York. 1951.
Guthrie, John D. Virginia. 1942.

Hall, William L. Arkansas. 1940.
Hartley, Carl P. Maryland. 1949.
Hawes, Austin F. Connecticut. 1939.
Hawley, Ralph C. Connecticut. 1942.
Heintzleman, B. Frank. Alaska. 1951.
Holmes, J. S. North Carolina. 1939.
Hosmer, Ralph S. New York. 1932.
Hunt, George M. Wisconsin. 1951.

Illick, Joseph S. New York. 1946.
Isaac, Leo A. Oregon. 1953.

Jeffers, Dwight S. Oregon. 1948.

Kelley, E. W. California. 1949.
Kellogg, Royal S. Florida. 1949.
Kinney, Jay P. New York. 1942.
Kittredge, Joseph. California. 1953.
Korstian, Clarence F. North Carolina. 1942.
Krueger, Myron E. California. 1951.

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Lowdermilk, Walter C. California. 1948.
MacDonald, G. B. Iowa. 1944.
Marsh, Raymond E. District of Columbia. 1948.
Martin, Clyde S. Washington. 1948.
Mason, David T. Oregon. 1948.
McArdle, Richard E. District of Columbia. 1953.
Metcalf, Woodbridge. California. 1953.
Morrell, Fred W. Virginia. 1951.
Mulford, Walter. California. 1939.
Munger, Thornton T. Oregon. 1946.
Munns, Edward N. California. 1949.
Preston, John F. District of Columbia. 1948.
Price, Jay H. Arizona. 1951.
Schmitz, Henry. Washington. 1940.
Shirley, Hardy L. New York. 1951.
Show, S. B. California. 1948.
Siecke, E. O. Texas. 1946.
Sparhawk, William N. New Hampshire. 1946.
Watts, Lyle F. Oregon. 1946.
Winslow, C. P. Washington. 1942.
Wirt, George H. Pennsylvania. 1948.
Ziegler, E. A. Pennsylvania. 1949.
Zon, Raphael. Minnesota. 1918.

Mettler's Woods

The campaign to preserve Mettler's Woods in New Jersey as a Natural Area has now reached the $50,000 mark. This area, so beautifully portrayed in the November 8, 1954 issue of *Life* magazine, is believed to be the only remaining climax stand of hardwood on the Eastern Seaboard. The present owner was forced to dispose of the 65 acres of trees as well as the 71 acres of protective surrounding field. A Citizens Committee for the Preservation of Mettler's Woods was formed a year and one-half ago to raise the $75,000 necessary to buy the property and give it to Rutgers University for preservation as a Natural Area.

Now with two-thirds of the required funds at hand, the campaign passes into its final stages. The project has now progressed so far that it cannot be abandoned. What is needed are contributions from those that have not yet been reached.

The goal is worthy of the support of all foresters. There is an increasing need by practicing foresters for a more comprehensive knowledge of natural developments within virgin forest associations. Here is an opportunity to partially satisfy that need. All contributions should be sent to Professor William H. Cole, Secretary of the Citizens Committee, Rutgers University, New Brunswick, New Jersey.

JOHN F. SHANKLIN
Chairman, Committee on Natural Areas

Report on the Activities of the Forest Soils Committee for the Douglas Fir Region[1]

Forestry is a renewable natural resource industry and, as such, is dependent upon the basic resource, the forest soil. Recognition of the importance of forest soils in the successful management of forest lands for maximum production of wood resulted in the formation of a "Forest Soils Committee for the Douglas Fir Region" in 1948 under the sponsorship of the Society of American Foresters. Perhaps one measure of the success of this committee in stimulating forest soils re-

[1]This report was presented at the 45th Annual Western Forestry Conference, San Francisco, California, December 8, 1954.

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search is the fact that seven out of fourteen forest soils papers presented at the recent annual meeting of the Soil Science Society of America at St. Paul, Minnesota, were papers from the Douglas-fir Region.

The Forest Soils Committee maintains a schedule of three meetings a year of which the spring meeting is held in Washington, the summer meeting is a two-day field trip, and the winter meeting is held in Oregon. To further one of the committee's primary objectives, that of stimulating research, a one-day meeting to review research in forest soils was held last March at the University of Washington. Current research in the region was carefully reviewed and forest soils problems needing study were summarized. Thus this committee not only serves in pointing out priorities in soils research, but also acts as a coordinating group for forest soils activities in the region, thereby preventing duplication of research effort.

During the summer field meetings areas are visited where forest soils field work is in progress. Such meetings emphasize the practical aspects of forest soils and methods of approaching forest soils problems. The 1954 field meeting was held on the Olympic Peninsula near Forks, Washington, where Rayonier, Incorporated, has undertaken forest soils studies relating to pulp timber and cellulose production. The Committee also visited the 1951 Forks Burn to learn about problems being encountered in managing and reforesting the burn.

Progress was made during the past year toward completion of a Forest Soils Manual for the Douglas-fir region. Aimed at making essential facts about forest soils readily available to practicing foresters, this manual will summarize all present knowledge on forest soils of the region. Detailed outlines have been completed for the sixteen chapters to be included, and several chapters are partially completed. From the information gathered for this Forest Soils Manual, a brief chapter on application of forest soils information in forest management will be prepared for incorporation in the West Coast Forestry Procedures Manual published by the Western Forestry and Conservation Association.

Forest soils testing service was another problem which received attention this past year. Forest soils workers have been handicapped by not having a service through which analytical tests of forest soils samples could be readily obtained. As a result of cooperative action, this service is now available through the Soil Testing Laboratory at Oregon State College.

Forest soils work within the region has been further expanded in the past year by cooperative studies at Oregon State College financed by the Bureau of Land Management and the Oregon State Board of Forestry. Active graduate research programs in forest soils are maintained by both Oregon State College and the University of Washington. At the same time forest soils programs of other public and private forestry organizations are making real progress in providing the practicing forester with better information for managing forest lands for sustained yield production. The Forest Soils Committee looks ahead to a continued expansion of forest soils research. Such a program is necessary to supply accurate soils information for the management of forest lands in the Douglas-fir region to produce the highest possible return for the money invested.

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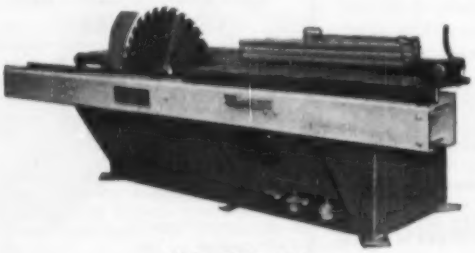

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Necrology
December 1, 1953-November 30, 1954

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Koch, Elers, Missoula, Montana
Sterling, E. A., Montrose, Pennsylvania

Member

Anderson, Emil A., Kalispell, Montana
Bancker, John S., Augusta, Maine
Brandeberry, J. K., Lincoln, Nebraska
Cram, Wilson D., Toronto, Ontario, Canada
Dunston, C. E., San Francisco, California
Emerick, R. Lynn, Elizabethtown, Pennsylvania
Emerson, J. Ward, Dolores, Colorado
Fletcher, E. D., Winchester, Massachusetts
Frazier, William T., Watsonville, California
Freeman, John R., Berkeley, California
Gooch, W. L., West Point, Virginia
Graham, C. L., Laconia, New Hampshire
Griffith, C. W., Monroe, Louisiana
Halligan, James, Minneapolis, Minnesota
Herlevich, Joe, Whiteville, North Carolina
Hubert, Ernest E., Moscow, Idaho
Johnson, Eric A., Bethesda, Maryland
Lecte, Bernard E., Chillicothe, Ohio
Linn, Edward R., Stillwater, Oklahoma
Mansell, Maurice A., Stoddard, New Hampshire
Mead, Ernest J., Hammond, Louisiana
Parnelle, Robert E. Bainbridge, Georgia
Rockwell, Frank I., Minneapolis, Minnesota
Sinclair, Robert Y., Lincoln, New Hampshire
Sweet, Carroll V., Madison, Wisconsin
Tanner, E. B., Portland, Oregon
Wilber, C. P., Trenton, New Jersey

Junior

Duvall, Thure C., Cloquet, Minnesota
Jacobson, F. Arthur, Campbell, California
McGann, J. Rene, New York, New York
Rowe, Robert W., Centralia, Washington
Saltsman, David W., Rexford, Montana
Wetzel, Walter Warren, Berkeley, California
Williams, Robert J., Roseburg, Oregon

Affiliate

Lawton, James Maner, Soperton, Georgia

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of January are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of April 1, 1955. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Augsburger, G. W. Marquis, D. A.
Griffin, J. B.

Junior Grade

Houts, R. F., Cartographer, Michael Baker Jr., Inc., Beaver Falls, Pa.; Pa. State, B.S.F., 1952.
Minear, R. W., Parsons, West Virginia; Univ. of Ga., B.S.F., 1936. Reinstatement.
Parsons, J. H., Pine Grove, W. Va.; W. Va. Univ., B.S.F., 1951. Reinstatement.
Wine, R. C., 127 N. 6th St., Indiana, Pa.; Pa. State, B.S.F., 1950. Reinstatement.

Member Grade

Beach, J. E., Project Leader, Cons. Comm. of W. Va., Elkins, W. Va. (Junior, 1948).
Burke, H. G, Dist. Mgr., Osmose Wood Preserving Co., Nitro, W. Va.; W. Va. Univ., B.S.F., 1950. (Junior, 1951).
Longacre, G. V., Forester, Webster Hardwood Lbr. Co., Dixie, W. Va. (Junior, 1948).
Pickall, A. J., Dist. Forester, Md. Dept. of Forests & Parks, Laurel, Md. (Junior, 1948).
Thompson, N. W., Box 292, Lewisburg, W. Va. (Junior, 1948).

Affiliate Grade

Myers, P. D., Forester, W. Va. Cons. Dept., Charmco, W. Va. Reinstatement.

Appalachian Section

Member Grade

Barton, W. J., 4731 Cedar Springs Rd., Columbia, S. C. (Junior, 1948).
Campbell, W. S., Lee High Ct., Staunton, Va. (Junior, 1948).
Hardee, J. F., Area Representative, Continental Can Co., Raleigh, N. C. (Junior, 1948).
Jolly, A. L., 921 Marston Ave., Salem, Va. (Junior, 1947).
Jones, J. C., Consulting Forester, Box 473, Smithfield, N. C. (Junior, 1948).
Mitchell, W. P., Service Forester, N. C. Forest Service, Fayetteville, N. C.; N. C. State, B.S.F., 1951. (Junior, 1954).
Osborn, R. M., Forester, Camp Manufacturing Co., Franklin, Va. (Junior, 1948).
Ralston, C. W., Prof., Duke University, Durham, N. C. (Junior, 1948).
Slocum, R. W., Dist. Forester, Va. Forest Service, Richmond, Va. (Junior, 1946).
Turner, W. A., Logging Engr., Camp Mfg. Co., Inc., Franklin, Va.; Univ. of Mich., B.S.F., 1947. (Junior, 1948).
Wenrich, A. L., Chief Forester, Continental Can Co., Hopewell, Va. (Junior, 1946).
Wilson, S. L., Consulting Forester, 857 Congaree Dr., Florence, S. C. (Junior, 1948).
Waters, J. C., Area Forester, International Paper Co., Burgaw,, N. C. (Junior, 1948).

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Orvig, C. G.

Junior Grade

Bagley, W. T., Asst. Prof., College of Agric., Univ. of Neb., Lincoln, Neb.; Iowa State, M.S., 1940. Reinstatement.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Hickman, A. R. Johnson, N. E.
Hopkins, H. K.

Junior Grade

Bradley, R. L., Asst. Dist. Forester, Bur. of Land Mgmt., Roseburg, Ore.; Univ. of Wash., B.S.F., 1940. Reinstatement.
Brogan, P. D., Administrative Asst., Ore. State Board of Forestry, Salem, Ore.; Ore. State, B.S.F., 1948. Reinstatement.
Burgess, T. H., Asst. Regional Forester, U.S.F.S., Portland, Ore.; State Univ. of N. Y., B.S.F., 1924. Reinstatement.
Chilcote, W. W., Asst. Prof., Dept. of Botany, Ore. State, Corvallis, Ore.; Iowa State, B.S.F., 1943; Ph.D., 1950. Reinstatement.
Crom, D. D., 1445 Oak Dr., Eugene, Ore. Reinstatement.
Evatz, E. R., Forester, Bur. of Land Mgmt., Eugene, Ore.; Utah State Agric., B.S.F., 1951.
Hayman, M. F., Log Scaler, Columbia River Log Scaling & Grading Bureau, Hood River, Ore.; Ore. State, B.S.F., 1939. Reinstatement.
Horne, G. F., Asst. Dist. Forester, Bur. of Land Mgmt., Salem, Ore.; Colo. A & M, B.S.F., 1946; Ore. State, M.F., 1950.
Kjosness, J. O., Bull-Buck, Upco Logging Co., Myrtle Creek, Ore.; Univ. of Wash., B.S.F., 1939. Reinstatement.
Krueger, O. C. F., Dist. Forester, Bur. of Land Mgmt., Eugene, Ore.; Univ. of Idaho, B.S.F., 1927. Reinstatement.

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Liniger, P. F., Forester, Industrial Forestry Assoc., Portland, Ore.; Univ. of Wash., B.S.F., 1939. Reinstatement.
Mickalonis, J. J., Mgmt. Asst., State of Ore., Astoria, Ore.; Pa. State, B.S.F., 1941. Reinstatement.
Stearns, A. C., Asst. Mgr., Kohala Sugar Co., Hawi, Hawaii; Univ. of Minn., B.S.F., 1938. Reinstatement.
Vladimiroff, B. T., Asst. Dist. Forester, Bur. of Land Mgmt., Roseburg, Ore.; Mich. State, B.S.F., 1940. Reinstatement.

Member Grade

Anderson, R. E., Forester, U.S.F.S., Helo, Ore.; Univ. of Wash., B.S.F., 1931. Reinstatement.
Ehinger, P. F., Forest Eng., Edward Hines Lbr. Co., Westfir, Ore.; Univ. of Mich., B.S.F., 1946. (Junior, 1947).
Langdon, H., Forest Eng., U.S.F.S., Medford, Ore.; Univ. of Calif., B.S.F., 1946. (Junior, 1948).
Makey, T. H., Appraisal Eng., State Tax Comm., Salem, Ore.; Purdue Univ., B.S.F., 1945. (Junior, 1948).
Merriam, L. C., Tbr. Appraiser, Ore. State Highway Dept., Salem, Ore.; Univ. of Calif., B.S.F., 1948. (Junior, 1948).
Newberg, E. A., Partner, Newberg Bros., Nehalem, Ore.; Ore. State, B.S.F., 1948. (Junior, 1948).
Sanford, G. R., Dist. Ranger, U.S.F.S., Roseburg, Ore.; Colo. A & M, B.S.F., 1946. (Junior, 1947).
Tyler, C. E., Forester, Kappler Lbr. Co., Mulino, Ore.; Ore. State, B.S.F., 1940. (Junior, 1948).

Affiliate Grade

Young, I. E., Asst. Dist. Warden, Coos Forest Protective Assoc., Coos Bay, Ore.

Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Christensen, D. E. — Thornburg, D. L.
Hillmer, D. F.

UNIVERSITY OF MICHIGAN

Bredernitz, D. H. — Santala, A. R.
Fischer, W. C. — Williams, C. B.

Junior Grade

Eloff, J., 6400 Kentucky St., Gary, Ind.; Purdue, B.S.F., 1951. Reinstatement.
Manson, J. B., 1011 E. Franklin St., Crawfordsville, Ind.; Purdue, B.S.F., 1941. Reinstatement.
Marsicek, A. J., 4943 N. Keystone Ave., Chicago, Ill.; Purdue, B.S.F., 1949. Reinstatement.
Peterson, K. R., Dept. of Forestry, Mulford Hall, Univ. of Ill., Urbana, Ill.; Univ. of Mass., B.S.F., 1953; Yale, M.F., 1955.
White, O., Farm Forester, Ill. Div. of Forestry, Carthage, Ill.; Univ. of Mich., B.S.F., 1950. Reinstatement.

Member Grade

Rice, W. W., Prof., Southern Ill. Univ., Carbondale, Ill.; Univ. of Maine, B.S.F., 1948; Yale, M.F., 1949. (Junior, 1949).

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Lytle, J. L.

Junior Grade

Cordon, F. C., Staff Forester, La. Forestry Comm., Baton Rouge, La.; L.S.U., B.S.F., 1949.
Furnival, G. M., Stoneville, Miss.; Univ. of Ga., B.S.F., 1948. Reinstatement.
Gardner, L. D., Forest Mgr., St. Regis Paper Co., Ocean Springs, Miss.; State Univ. of N. Y., B.S.F., 1940.
Kirby, J. O., Forest Admin., U.S.F.S, Meadville, Miss; Univ. of Mich., B.S.F., 1933. Reinstatement.
McFatter, D. L., Dist. Forester, La. Forestry Comm., DeRidder, La.; L.S.U., B.S.F., 1949.
Sanders, D. B., Grad. Student, L.S.U., Baton Rouge, La.; L.S.U., B.S.F., 1951.
Smith, A. A., Forest Consultant, Box 644, Crockett, Texas; Colo. A & M, B.S.F., 1940.

Member Grade

Eldridge, I. F., Dist. Forester, Champion Paper & Fiber Co., Kirbyville, Texas; L.S.U., B.S.F., 1947. (Junior, 1948).

Affiliate Grade

Donceel, G. T., Dist. Forester, Southwestern Settlement & Dev. Corp., Kirbyville, Texas; Okla. A & M, B.S., (Forestry), 1953.
Ruby, J. D., Engr. Sec. A.P.O. 234, San Francisco, Calif.; Stephen F. Austin State College, B.S., (Forestry), 1954.
Seago, E. V., Dist. Forester, Southland Paper Mills, Inc., Corrigan, Texas; Stephen F. Austin College, B.S., (Forestry), 1951.

Associate Grade

Brown, J. N., Asst. Mgr., Haynes Mfg. Co., Livingston, Texas.
Kardell, S. C., P.O. Box 25, San Augustine, Texas.

Intermountain Section

Junior Grade

Greenway, G. H., Forester, MacGregor Logging Co., Boise, Idaho; Univ. of Idaho, B.S.F., 1938.
Hunter, D. B., 211 S. Wardwell, Emmett, Idaho; Pa. State, B.S.F., 1949. Reinstatement.
Shaw, W. H., Asst. Forest Supv., Boise Natl. Forest, Boise, Idaho; Univ. of Idaho, B.S.F., 1936. Reinstatement.

Kentucky-Tennessee Section

Affiliate Grade

Goodrich, T. K., Asst. Land Mgmt. Forester, Bowaters Southern Paper Corp., Cleveland, Tenn.; Purdue, B.S., (Wood Utilization), 1949.

New England Section

Student Grade

UNIVERSITY OF MAINE

Benger, A. D. — Mitchell, W. C.
Combes, J. A. — Shedd, E. W.
Long, L. E. — Towle, E. L.

UNIVERSITY OF MASSACHUSETTS

Willard, R. E.

Affiliate Grade

Hawley, S. S., Forester, Great Mt. Forest, Falls Village, Conn.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Longtine, R. C.

Junior Grade

Hutchinson, J. G., 58 Stratford Rd., Scarsdale, N. Y.; State Univ. of N. Y., B.S.F., 1952.

Northern California Section

Junior Grade

Baker, R. D., 2000 Durant Ave., Berkeley, Calif.; Univ. of Calif., B.S.F., 1951. Reinstatement.
Chamberlain, J. E., Cartographer, C. S. Geological Survey, Sacramento, Calif.; Mont. State, B.S.F., 1951. Reinstatement.
Dozier, J. C., Forester, Associated Lbr. & Box Co., North Fork, Calif.; Univ. of Calif., B.S.F., 1947. Reinstatement.
Holt, T. M., Area Forester, Bur. of Indian Affairs, Sacramento, Calif.; Univ. of Minn., B.S.F., 1934. Reinstatement.
Nicholson, J. A., Forester, Crawford Lbr. Co., Redding, Calif.; Univ. of Calif., B.S.F., 1942. Reinstatement.
Pong, W. Y., 2600 Etna St., Berkeley, Calif.; Univ. of Calif., B.S.F., 1953.
Ray, R. L., Consulting Forester, Box 712, Ukiah, Calif.; Univ. of Calif., B.S.F., 1949.

Affiliate Grade

Dilts, R. E., Asst. State Forest Ranger, Calif. Div. of Forestry, Coalinga, Calif.

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Northern Rocky Mountain Section

Junior Grade

Cramer, J. E., Forester, A.C.M. Co., Bonner, Mont.; Mont. State, B.S.F., 1950.
Fallman, J. A., Forest Supv., U.S.F.S., Butte, Mont.; Univ. of Mont., B.S.F., 1930. Reinstatement.
Griffes, R. B., Forester, Anaconda Copper Mining Co., Missoula, Mont.; Mont. State, B.S.F., 1952.
Hayes, R. C., Forester, Tree Farmers, Inc., Missoula, Mont.; Mont. State, B.S.F., 1953.
Lamley, R. E., Forester, Anaconda Copper Mining Co., Marion, Mont.; Mont. State, B.S.F., 1952.
Quesenberry, J. R., Forester, A.C.M. Co., Missoula, Mont.; Mont. State, B.S.F., 1952.

Member Grade

Baldwin, D. D., Nursery Supt. Mont. State, Missoula, Mont.; Univ. of Minn., B.S.F., 1935. Reinstatement.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Roloff, G. A.

Junior Grade

Musbach, R. A., Asst. Dist. Forester, Mo. Cons. Comm., Rolla, Mo.; Univ. of Mo., B.S.F., 1950.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Bailey, J. G.
Benson, S. A.
Dalrymple, L. K.
Flora, D. F.
Hawley, R. J.
Michelotti, N. C.
Parnell, H. L.
Partee, D. W.
Rush, D. E.
Smith, T. G.

Junior Grade

Adams, W. H., Fire Control Aide, Bur. of Land Mgmt., Palmer, Alaska; Mont. State, B.S.F., 1949.
Brown, W. E., Asst. Dist. Warden, State Div. of Forestry, Enumclaw, Wash.; Iowa State, B.S.F., 1952.
Carver, G. C., Forester, Pope & Talbot Inc., Port Gamble, Wash.; Univ. of Wash., B.S.F., 1951.
Grobey, J. H., 4329 Semple, Seattle, Wash.; Univ. of Wash., B.S.F., 1954. (Student, 1954).
Pomeroy, R. M., Forester, U.S.D.A., Darrington, Wash.; Univ. of Calif., B.S.F., 1949.
Poust, A. A., 3123 Hoadley St., Olympia, Wash.; Ore. State, B.S.F., 1937; M.F., 1941. Reinstatement.

Member Grade

Clements, P. H., Forester, Cascade Lbr. Co., Ellensburg, Wash. (Junior, 1948).
Olhava, J. P., Box 66, Port Gamble, Wash. (Junior, 1948).
Weisgerer, J. E., U.S.F.S., Juneau, Alaska. (Junior, 1948).

Southeastern Section

Junior Grade

Raum, H. R., Dist. Ranger, U.S.F.S., Wiima, Florida; Iowa State, B.S.F., 1946.
Smith, A. E., Area Mgr., Gair Woodlands Corp., Macclenny, Fla.; W. Va. Univ., B.S.F., 1940. Reinstatement.
Stamey, G. M., Box 493, Dublin, Ga.; Univ. of Ga., B.S.F., 1949. Reinstatement.
Swift, C. S., 610 7th Ave., Opelika, Ala.; A.P.I., B.S.F., 1951. Reinstatement.

Member Grade

Gibbons, W. E., 231 Magnolia Ave., Evergreen, Ala. (Junior, 1948).
Shirley, A. R., 108 W. Hill Ave., Valdosta, Ga.; Univ. of Ga., B.S.F., 1936. Reinstatement.
Stone, E. B., Box 24, Lincolnton, Ga.; Yale, M.F., 1921. Reinstatement.
Weaver, L. J., 405 S. Anniston Ave., Sylacauga, Ala.; Univ. of Ga., B.S.F., 1937. Reinstatement.
Wharton, W. L., 2509 Richards Ave., Mobile, Ala. (Junior, 1948).

Affiliate Grade

Murphy, A. A., Forester, U.S.F.S., Palatka, Fla.

Southwestern Section

Junior Grade

Roll, T. A., Roll, Arizona; Utah State Agric., B.S.F. 1953. Reinstatement.

Affiliate Grade

Cottam, E. W., Dist. Forest Ranger, U.S.F.S., Carlsbad, N. Mex.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Kastelic, J. P.
Lefler, M. E.
Quirk, J. T.

UNIVERSITY OF MINNESOTA

Rankenburg, B.

Junior Grade

Allman, F. D., 1047 Pammel Ct., Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1953).
Blyth, J. E., 1104 Roosevelt, Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1954).
Goff, C. R., 2816 Wood St., Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1953).
Keesey, J. C., 1316 Leighton St. Keokuk, Iowa; Iowa State, B.S.F., 1954. (Student, 1954).
Larsen, D. E., Box 703, Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1953).
Lukkarila, R., 208 Seventh St., Chisholm, Minn.; Univ. of Minn., B.S.F., 1950. Reinstatement.
McCarron, D. H., 1985 Chaney Rd., Dubuque, Iowa; Iowa State, B.S.F., 1948. Reinstatement.
Peterson, R. E., 930 Pammel Ct., Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1954).
Wiles, M. G., 1013 Pammel Ct., Ames, Iowa; Iowa State, B.S.F., 1954. (Student, 1954).

Associate Grade

Norris, D. M., Grad. Asst., Iowa State, Ames, Iowa; Iowa State, B.S., (Entom. & Zoology), 1952; M.S., (Entom.), 1953.

Washington Section

Junior Grade

Brown, G. N., 3357 Rittenhouse St., Washington, D. C.; Mich. State, B.S.F., 1938. Reinstatement.

Associate Grade

Craig, J. B., Editor, American Forests, Washington, D. C.
Erickson, T. A., 2016 T St., Washington, D. C. Reinstatement.

Wisconsin-Michigan Section

Member Grade

Johnson, H. E., 1031 Hawley Rd., Mason, Mich. (Junior, 1948).
Ricker, D. L., Dist. Ranger, U.S.F.S., Manistique, Mich. (Junior, 1948).

Affiliate Grade

Davidson, R. E., Mgr., Forest Products Div., Kingsford Chemical Co., Niagara, Wis.

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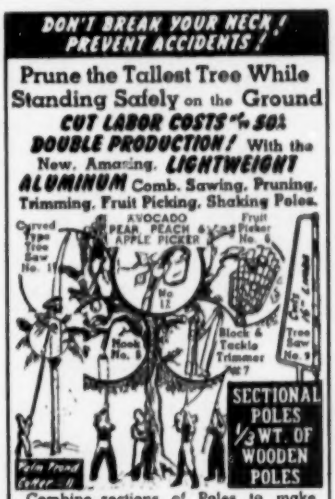
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Forestry News

Golden Anniversary of U. S. Forest Service Commemorated

The 50th anniversary of the creation of the Forest Service as a federal agency in the Department of Agriculture was marked by a dinner at the Statler Hotel in Washington, D. C., on February 4. Sponsored by the Society of American Foresters and the American Forestry Association, the event drew together 500 friends, coworkers, and members of the Service from all parts of the country.

The Forest Service came into being in its present form on February 1, 1905, during the presidency of Theodore Roosevelt, through merger of the then existing Bureau of Forestry and the forestry division of the General Land Office.

MRS. GIFFORD PINCHOT, whose late husband was the first chief of the U. S. Forest Service, shown participating in a dramatization marking the fiftieth anniversary of the Service.

Honored guests at the dinner included Mrs. Gifford Pinchot, whose late husband was the first chief of the Service; Ralph S. Hosmer, coworker of Pinchot's and a charter member of the Society of American Foresters; and Lyle F. Watts and Earle H. Clapp, retired chiefs of the Service, as well as Richard E. McArdle, the present chief. Attendance included a number of congressmen, representatives of national conservation organizations, the timber industry, and various governmental and private agencies.

A reception preceded the dinner. In its receiving line stood Mrs. Pinchot, Elwood L. Demmon, S.A.F. president, Don P. Johnston, A.F.A. president, and Messrs. Clapp, Watts, and McArdle.

Mr. Johnston and Mr. Demmon jointly presided over the program which opened with a message from President Eisenhower, read by Mr. Johnston. (See box.)

Under Secretary of Agriculture True D. Morse spoke of the contribution of the national forests to the American free economy. He pointed to a greatly increased annual cut from them, said that they "must be protected and much further developed." He mentioned "concern over a situation where only 2 percent of an estimated 84,000 mining claims in the national forests are actually being commercially mined."

Sherman Adams, assistant to President Eisenhower, and himself a member of both the American Forestry Association and The Society of American Foresters, vowed the federal government's continued advocacy of the policies of Roosevelt and Pinchot "against waste and pilferage" and for "public utilization" of natural resources.

Richard E. McArdle, present chief of the Service, expressed his appreciation of the honor bestowed upon his agency. He stressed the importance to the Forest Service of the devoted and often unsung work of its individual members on the national forests. He called attention to the cooperative programs that have made his agency the coworker of state and private efforts to better the nation's resources.

A dramatized narration, "The Blazed Trail," read by William W. Bergoffen, traced the development of the Forest Service during each of the five decades of its history.

A music program concluded the dinner, presenting the U. S. Air Force orchestra and Singing Sergeants, and drawing enthusiastic applause from the audience.

THE WHITE HOUSE

February 1, 1955

Dear Mr. Johnston:

Please convey my greetings to the members of the American Forestry Association and the Society of American Foresters, and to all attending the dinner which these organizations are sponsoring in honor of the golden anniversary of the Forest Service. Through half a century, the Forest Service has developed a fine tradition in administering our national forests, conducting research, and working with State forestry departments and private landowners. Its work constitutes a central part of our national effort to conserve, develop, and wisely use our forest resources.

As our nation's population steadily increases, all of us must be concerned with keeping our forests productive and protecting the watersheds on which they grow. In years ahead we shall need more homes, more furniture, more paper, more opportunities for outdoor recreation, more pure water. We can be thankful that we have active forestry organizations, public and private, directing their efforts toward a development and use of our forest lands which will help assure their productivity in years ahead. For such a goal can best be attained by cooperation among Federal, State and local governments, and private citizens.

In congratulating the Forest Service on its fiftieth birthday, I salute its members who assemble in Washington for this anniversary dinner and its many other members located throughout the country. May all of you carry on in the same splendid tradition through the next half century.

Sincerely,

/S/ DWIGHT D. EISENHOWER

Mr. Don P. Johnston
President
The American Forestry Association

Ralph S. Hosmer Honored

A forest plantation in the national park on the island of Maui, Territory of Hawaii, has been named the Ralph

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WORLD'S LARGEST CHAIN SAW BUILDERS

Integration of Grazing and Timber Production in the Deep South

By ROBERT S. CAMPBELL

Abstract

Range grazing promises to continue as a permanent use of forest land in the South, mainly in the longleaf-slash pine belt of the Coastal Plain. In the Coastal Plain, range grazing can be well integrated with protection measures on pine forest lands. Such measures involve the establishment of grazed firebreaks, moderate grazing to reduce grass fuel, and prescribed burning primarily for silvicultural purposes. Protection also involves the reduction to a minimum of grazing damage to pine regeneration. Cattle are preferred on pine forest range, because under moderate grazing they cause less damage to tree reproduction than hogs, sheep, and goats. Grazing in the bottomlands, except the switch cane type, is generally undesirable because of browsing damage to valuable hardwood sprouts and seedlings.

The range and livestock management practices important in integrated use of timber and range are: placing proper number of livestock on the range and attaining proper distribution of animals. Since the range is inadequate in winter and of low value in fall, adequate nutrition during these periods requires either supplemental feeding or removal to improved pastures.

Many commercial forest landowners do not wish to enter the cattle business, but prefer to lease their grazing rights to private stockmen. The requirements of a satisfactory lease-agreement are summarized.

Paper delivered at 1954 annual S.A.F. meeting and appearing in the published proceedings of that meeting.

S. Hosmer Grove, in honor of Prof. Hosmer of Ithaca, N. Y., the first territorial forester.

A 1902 graduate of the Yale School of Forestry, Prof. Hosmer worked briefly in the U. S. Forest Service before going to Hawaii in 1904 as superintendent of forestry. He served there for ten years, until 1914 when he became head of the forestry faculty at Cornell.

The coniferous grove named in his honor is the result of experiments started by him to introduce species from the United States, mainly the California mountains, to determine whether they would grow and reproduce at the higher elevations above the rain (trade wind) forest. The experiment was successful.

J. H. Kraemer Returns from Korea

Dr. J. Hugo Kraemer, chief of the Division of Forestry of the United Nations Korean Reconstruction Agency, has returned to the United States after nearly two years directing the U.N. forestry program in Korea. With over 73 percent of the land area in non-agricultural land, and nearly all of the timber removed, the rehabilitation of the forest resources is one of the most important aspects of the reconstruction work in the Republic of Korea. Material for the rebuilding of war-torn cities and fuel for heating and cooking are very critical items and will be for some time to come. Direct aid and technical assistance were given in the UNKRA forestry program which consisted of five parts—forest administration, education, research, extension, and a peat production project. The program was designed to have long range as well as immediate reconstruction effects. With the program organized and financed, it is believed that the Korean foresters can now continue largely on their own. Dr. Kraemer plans to return to professional forestry in the United States.

Budworms and Bark Beetles Continue Epidemic Status in Oregon

Spruce budworms and bark beetles continue in an epidemic status in various forested regions of Oregon at the end of 1954, according to a joint statement issued by State Forester George Spaur and R. W. Cowlin, director of the Pacific Northwest Forest and Range Experiment Station.

Just where these insects are continuing their attacks on the forests was determined through 100 aerial mapping hours which covered 22,000,000 acres of Oregon's forested lands. Ground checks were made to determine the intensity of the infestations.

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The survey indicated that the spruce budworm is making serious threats to a little more than a million acres in the Blue Mountains of northeastern Oregon. Reports indicate that 607,000 acres will have to be treated this summer if the insect is to be kept in check. Additional acreage may have to be treated in 1956.

The Ochoco and Malheur National Forests have identical areas of serious infestations to be treated, totaling 231,000 acres each. In addition, there are the Baker-Susanville area of 77,000 acres and the Catherine-Eagle Creeks area of 68,000 acres. No new outbreaks were found in either western Oregon or the Cascade Mountains.

During the period 1949-53 control measures were successfully carried out on 3,220,000 acres of infested forests and no reinfestations were found. However, the report indicates that unless current infestations are controlled, the insects are likely to spread to treated areas.

The Douglas-fir bark beetle continues in epidemic status on 4,440,540 acres of western Oregon forests but the intensity was found to be decreasing except in the Smith River area of the Coast Range and in the watershed of the Clackamas and Middle Fork of the Willamette Rivers.

The beetle infestation went hand in hand with the serious blow-down of the winter of 1950-51 and the records now indicate that the combined tree mortality has been 15 billion board feet with a little more than three billion board feet due to the beetles.

In eastern Oregon the western pine beetle infestation has declined from 1,000,000 acres in 1953 to 268,000 acres in 1954. This is largely due to sanitary-salvage logging within the infested areas.

Industrial & Private

C. J. Blades Named N.C. Outstanding Forester for 1954

Carolton J. Blades, chief forester of the Duke Power Co., Charlotte, North Carolina, was honored by the North Carolina Forestry Association by being designated "Outstanding Forester" for 1954. This award has been sponsored annually by the Association since 1952.

Blades has been with the company since 1939, excluding a tour of duty during World War II with the Corps of Engineers.

His management of the company's forest land, in excess of 200,000 acres, was cited as an example of "outstanding achievement" in multiple use. It is directed toward attaining watershed protection, the annual production of commercial timber crops, and recreational facilities for the public.

Western Pine Tree Farm Program Stresses Small Ownerships

The Western Pine Association has reported a total of 650 certified Tree Farms at the end of 1954, with 190 added during that year.

Association foresters report that a significant trend in the program in the 12-state western pine region is the increased interest among small owners in organizing their forest tracts for tree growing. Until recently the main emphasis of the tree farm program has been on large ownerships in the area.

Tree farms in the region now total 5,689,000 acres.

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Connecticut

62 percent forested, in a highly industrialized economy

From the early days when the Charter Oak sheltered the Royal Charter, the people of Connecticut have shown sustained interest and faith in their trees. Early colonists, faced with extensive forests (—98 percent of all area) met the land-clearing challenge so successfully that, by the middle 1800's, only 30 percent of the land remained under forests.

Since then, Connecticut has proven conclusively that forestry and industry can thrive together. Through an effective reforestation program, forestlands in this highly industrial state have been restored until they cover almost two thirds of the entire state.

Ownership of Connecticut forests is divided among private, state, county and municipal holdings,—with private holdings far in the lead. Forest "plantations", which account for 40,000 acres, trace their history here back more than 100 years,—although the majority were established during this century.

Trained foresters aid the owner in handling his woodland; a state-maintained nursery produces and distributes, at cost, forest tree seedlings.

All woodlands were put under organized fire protection in 1905. The program has increased in effectiveness to the point where the annual burned-over average is less than one-tenth of one percent. The record owes much to the effective use and cooperation given the program by Connecticut television and radio.

—CONNECTICUT STATE PARK AND FOREST COMMISSION AND AMERICAN FOREST PRODUCTS INDUSTRIES, INC. — *Contribution to this series does not necessarily constitute endorsement of Southern Glo products.*

In colonial New England, pines selected for masts for England's merchant marine and navy were marked with the "broad arrow" of the king.—And woe be unto him who cut one of these marked trees for any other purpose! Today, owners who value their timber often mark with SOUTHERN GLO tree marking paints. Easier and more economical to apply than the mark of a blazing axe, SOUTHERN GLO is highly visible,—lasts up to 5 years. In Ready-Mixed, Paste or Boundary-marking consistency,—all based on the exclusive Stay-Mixed Formula #71020 that keeps SOUTHERN GLO tree marking paints soft-settling.

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GOVERNOR JOE FOSS presents a South Dakota button to Bernard Orell as George Kelly (left)-assistant state forester, Robert Atkins (center), and Harry Woodward (right) state forester, look on.

Orell Addresses South Dakota Keep Green Association

The annual meeting of the Keep South Dakota Green Association was held in Pierre, South Dakota on January 6. Principal speaker for the occasion was Bernard L. Orell, vice president, Weyerhaeuser Sales Company, and former supervisor of forestry for the State of Washington. He was introduced at the banquet by South Dakota's new Governor, Joe Foss, who had taken office just two days before. Orell commented upon the forestry situation in the nation and then commended all of the Keep Green groups in the various states for the fine progress that has been made as a result of their volunteer efforts.

Tree Farm System Adds Three and a Half Million Acres During 1954

The industry-sponsored American Tree Farm System reports that the greatest progress in its 14-year history occurred during 1954.

A total of 3,573,708 acres of woodlands were brought into the system during the year, bringing the total of certified Tree Farm acreage up to 33,692,964. In announcing these figures James C. McClellan, chief forester for A. F. P. I., predicted five million acres will be added in 1955.

Texas continues to lead Tree Farm states, with 3,429,363 acres, representing 636 ownerships. Washington, the state where the program began back in 1941, is second with 3,259,806. Oregon passed Arkansas during 1954 to take third place in the national Tree Farm standings with 3,231,388 acres. Arkansas is fourth with 3,136,948.

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Mississippi stands second to Texas in number of tree farmers with 520. Alabama and Arkansas are third and fourth with 477 and 404 units respectively.

Thirty-six states now have Tree Farm programs underway.

A. F. P. I., which keeps records on the program, reports that the 6,063 names on its rolls at the close of business December 31, 1954, included 299 women tree farmers.

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Homelite Corporation Scholarship to Washington Student

Don E. Rush of Seattle, 20-year-old junior in forest management at the College of Forestry of the University of Washington, has been awarded a $500 scholarship by the Homelite Corporation.

A. D. Sherwood, Homelite manager for Washington, Oregon, Idaho, and Montana, presented the scholarship which is awarded on the basis of scholarship, activities, need, and future promise in the field. The New York corporation is giving scholarships in leading forestry colleges in the country in place of annual Christmas gifts to customers.

In presenting the scholarship, Sherwood cited the corporation's primary interest in the spread of good forestry practices to all U. S. woodlands.

S.P.C.A. Holds Fifteenth Annual Meeting, Expresses Optimism

"The pulp and paper industry leads the parade in our southern economic revival," stated J. H. McCaffrey, Mobile, Ala., vice president of the International Paper Company. "With this leadership comes increasing responsibility." McCaffrey set the theme of the 15th anniversary meeting of the Southern Pulpwood Conservation Association held January 18 and 19 in Atlanta, Ga. He addressed 500 representatives of the South's pulp and paper industry, pointing out that the future will call for a doubling of the area's pulpwood production.

"The pulp and paper industry in the South is still in its infancy," stated T. W. Earle, Savannah, president of Gair Woodlands Corporation. Mr. Earle reviewed 15 years of progress by the industry which has grown to be a leader since 1939, and now produces over half the nation's demand in paper products.

"Our challenge today," Earle pointed out, "is to protect our 1½ billion dollar investment in the South by continuing our leadership in growing more trees."

H. J. Malsberger, Atlanta, forester-general manager for the Association, asserted that it is in the field of giving forestry aid on the ground to small timberland owners that the greatest progress was made in 1954. Actual timber marking service was furnished free of charge to some 8,500 landowners, on 482,100 acres, from which 1,015,300 cords of pulpwood were harvested. "The amount of pulpwood produced in 1954 would form a wall of wood four feet thick and 102 feet high around any city in the South."

The two-day meeting opened with a workshop for conservation foresters on the preparation and placement of news releases. The workshop featured a critique on an actual news story written by those attending.

P. R. Wheeler, of the Southern Forest Experiment Station, and E. L. Demmon, director of the Southeastern Station, summarized the forest inventory of those southern states in which a survey has recently been completed. "The consumption of pulpwood in the South in 1953 was eight times that in 1935," stated Wheeler. "This consumption has been backed by an enormous growth of young timber which is rapidly restocking the land."

Demmon estimated that the South's average forest growth can be almost doubled in the next 25 years.

It was pointed out to the industry leaders that tree planting has continued its upward spiral. Seedlings planted in 1954 reforested 180,250 acres of idle land. Replanting, together with natural reseeding, and harvesting of trees under good management practices can fulfill the goals of the South's pulp and paper industry in its program of insuring a continual supply of raw materials for the future.

The meeting was climaxed with a banquet presided over by D. E. Hess, chief forester of the Glatfelter Pulp Wood Company, Gettysburg, Pa.

L. M. Turner Returns from Iran

Dr. Lewis M. Turner, dean of the School of Forest, Range and Wildlife Management at Utah State College, returned in January from a four-month trip to Iran where he made plans for a national ranger school. He was working with Henry Kernan, chief of the Forestry Division, United States Operations Mission to Iran.

Planned is a two-year curriculum incorporating both field work and classroom-laboratory instruction, with options in both forest management and range management. Both courses include instruction in forest and range management, and watershed manage-

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ment, with some attention to forest recreation and game management. Iran's forest and much of her range land have problems of management and use in all or several of these fields. The problems of watershed management are particularly acute.

The new ranger school will be located practically in the Caspian forest, at an elevation of about 4,000 feet northwest of Tehran and near the small village of Calardasht. It will have a staff of six. The director will be Mohammed Abedi who has already visited the United States and who will be in training for a year in America before the school opens in the fall of 1956. Three other staff members will soon go to the states for further training in forest management and range management.

The capacity of the school is sixty, and it is planned to graduate around thirty men each year when well established. Presumably all the graduates will find employment in the Iranian Forest Service. This organization has recently established a major division of range management.

From time to time the Forest Service will send employees to the United States and Europe for further forest and range training. Particular attention will be given to continued training of the ranger school graduates who show exceptional ability and industry.

W. O. Edmondson Retires

W. O. Edmondson, extension forester and horticulturist, is planning to retire from the University of Wyoming Agricultural Extension Service effective March 31, 1955, after 26 years of service to Wyoming people in the farm forestry and horticultural fields. Over the years he has assisted farm and ranch people in their tree ordering, planting and cultural problems, and has directed the program of landscaping and yard improvement, as well as vegetable and fruit growing, on farms and for urban people.

Close to 9,800 orders for farm shelterbelt trees have been received at the University from farmers and ranchers over the state during the past 28 years, and over 3,230,900 trees have been planted into shelterbelts, and windbreaks and field plantings through the Clarke-McNary farm forestry program.

Hardwood Marketing to be Aided in Alabama

The Extension Service of Alabama Polytechnic Institute recently announced the appointment of Windell W. Vickery as forest products marketing specialist.

Mr. Vickery has previously served in north and central Alabama and east Georgia as forester for Southern Timber Management Service, and with the U. S. Forest Service on timber sales work in Arizona. He has a degree in forest utilization from Alabama Polytechnic Institute. He is secretary-treasurer of the Georgia-Florida-Alabama Section of the Forest Products Research Society and is a junior member of the Society of American Foresters.

In announcing the appointment, Ivan R. Martin, A. P. I. extension forester, stated that the project has been under consideration for several years. Its main purposes are to keep sawmill operators and farmers appraised of markets for low-grade hardwoods through listings supplied to county agents and others, promote the use of low-grade hardwood by industry, and

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A good road system permits harvesting by area selection in Douglas fir regions. This is a plan of cutting mature timber that provides for natural reforestation, retention of moisture in forest soil, and good forage and shelter conditions for wildlife.

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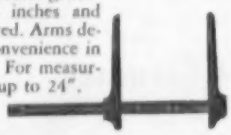

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interest possible new industries using such raw materials in locating in the state.

Staff Changes at Washington State College

E. H. Steffen, chairman, Department of Forestry and Range Management, State College of Washington, since 1919, relinquished administrative duties as of September 1, 1954. Professor John P. Nagle, a member of the Washington State College faculty since 1934, succeeds him as chairman.

Ernest T. Grover, Coeur d'Alene, Idaho, former assistant state forester of Idaho and logging engineer for Long Lake Lumber Company of Spokane, Washington, has been appointed research forester, Agricultural Experiment Station, Washington State College. Mr. Grover is a graduate of the New York State Ranger School and has his B.S. and M.F. from the College of Forestry, University of Idaho. He will conduct a state-wide study of marketing the products of farm and other small woodlands.

Texas Forest Service Fellowship Announcement: 1955-56

The Texas Forest Service announces the availability of three fellowships, to be granted to candidates for the degree of Doctor of Philosophy in the fields of forest genetics, forest physiology, or wood technology (anatomy). Candidates holding a master's degree in a plant science are preferred. The candidate may major in either the Departments of Biology, Plant Physiology, or Genetics of the Agricultural and Mechanical College of Texas, College Station, Texas.

Three fellowships are available, each on a 12 month basis. A fellowship to an out-of-state student will amount to $2,080 a year, including matriculation fees. A fellowship to a resident student will amount to $1,765, including matriculation fees.

For further information, address inquiry to Dr. A. D. Folweiler, Director, Texas Forest Service, College Station, Texas.

Montana Holds Interpretation Short Course

A short course in the "Use of Aerial Photos in Forestry" will be conducted by the Montana State University School of Forestry March 14-19, 1955. The six-day course for any forester or other person engaged in management of forest properties will offer one hour of graduate or undergraduate credit.

Louis W. Powell, instructor in surveying, mapping, and aerial photo interpretation, will be in charge of instruction, assisted by James L. Faurot, instructor in forest engineering, logging and timber mechanics, who will present the viewpoint of the forest engineer on using aerial photos.

This is the first school of its type sponsored by the Montana School of Forestry, but it will become an annual event if enough interest is shown.

Government

H. T. J. Cramer Retires from Wisconsin Department

The application of H. T. J. Cramer, assistant director of the Wisconsin Conservation Department, requesting voluntary retirement has been granted according to L. P. Voigt, acting conservation director.

Mr. Cramer first became associated with the Conservation Department as a forest ranger in 1931. He was promoted to district forest ranger in 1934. In 1935 he became forest area supervisor stationed at Black River Falls, the position he held until 1948 when he was chosen as assistant director.

During recent years he served as chairman of the deer survey committee in charge of organizing and managing a statewide investigation of deer yards and conducting a survey of deer damage to forest reproduction. He has also served on the Wisconsin Water Regulatory Board, the State Committee on Water Pollution and as chairman of the department's River Survey Committee. His professional affiliations include membership in the Society of American Foresters.

Louisiana New Tax Law Into Operation

Timber stumpage values set by the Louisiana Forestry Commission and the Louisiana Tax Commission recently will affect every forest landowner in the state, according to J. H. Kitchens, Jr., executive secretary of the Louisiana Forestry Association.

To conform with regulations under the new forestry taxation law which was approved by voters last November, the tax and forestry agencies set stumpage values each year. Starting January 1st, 1955, all timber severance taxes are based on these values. Starting July 1, 1956, parishes will receive 75 percent of severance proceeds from timber cut in the parish.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Available

Forester to handle timber sales and inspection work in Georgia. Applicants should have at least 4 years experience. Entrance salary, $4200.00. Apply on federal employment, Standard Form 57, which may be obtained from first and second-class Post Offices.
Box D, Journal of Forestry, Mills Building, Washington 6, D. C.

Positions Wanted

Forester, 25, B.S.F., Univ. of Michigan, 1953. Married, one child. At present an officer in U. S. A. F., in the field of communications. Expect to be released June 5th. Experience: U. S. Forest Service, Washington; lumber company, Michigan. Desire position in field of management or harvesting timber.
Box B, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, 25, B.S.F. Pa. State, 1951. Korean veteran, single. Experienced in management using photogrammetric means, scaling, public relations, cartography. Desires employment with private industry in eastern or southern states.
Box C, Journal of Forestry, Mills Building, Washington 6, D. C.

The new law provides a severance tax of 2¼ percent on saw timber and five percent on pulpwood, replacing the old system of levying a flat-rate tax such as one dollar per thousand board feet on cypress.

The following stumpage values were agreed upon for this year: Cypress, $25; pine, $25; ash, $10; hickory, $2.50; heart red gum, $40; other gums, $8; cow oak, $10; white oak, $10; red oak, $10; cottonwood, $8; magnolia, $12; poplar, $12; and sycamore, $8.

Stumpage values on pulpwood were set as follows: Pine pulpwood, $3; hardwood pulpwood, $1.

The change in severance tax is one of two major alterations in taxation of Louisiana timber. Another provision eliminates growing timber from the tax rolls, with all forest lands to be taxed according to four classifications: cypress, hardwood, longleaf pine, and other pine lands.

A. W. Toole Joins Lake States Station

Arlie W. Toole has joined the staff of the Lake States Forest Experiment Station at St. Paul, according to M. B. Dickerman, station director. Formerly a professor on the staff of Michigan College of Mining and Technology at Houghton, Mr. Toole will head up a new program stressing the management and utilization of hardwood timber.

In his new position, Toole will be responsible for developing utilization studies in cooperation with the forest industries and forest schools in Minnesota, Wisconsin, and Michigan. The objective of this work, according to Dickerman, will be to increase forest productivity through finding economical means of harvesting and processing the large volume of low-quality hardwoods, such as scrub oak and aspen.

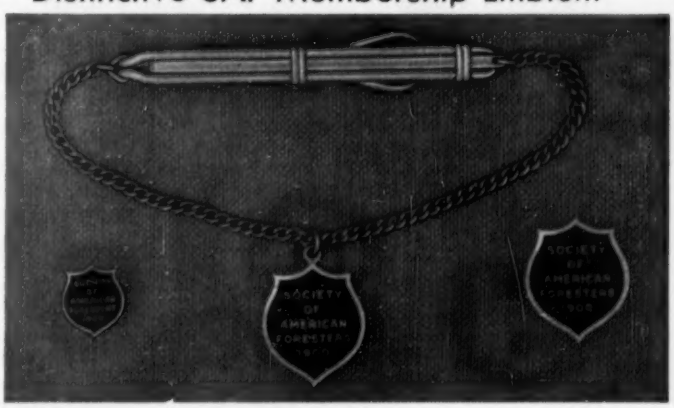
Toole is a graduate of the University of Idaho and served for 15 years with the U. S. Forest Service. A former supervisor of the Superior National Forest, he also has worked for private forest industry. For the past seven years he has specialized in utilization research and is the author of numerous publications.

N. D. Nelson New Area Two BLM Administrator

Neal D. Nelson, assistant range staff officer for the Bureau of Land Management, has been appointed BLM area administrator for Utah, Idaho, Nevada, and Arizona, Secretary of the Interior Douglas McKay has announced. Headquarters of the area are in Salt Lake City, Utah.

Nelson graduated in 1926 with a B.S. degree in education from the University of Idaho. In 1948 he received a B.S. degree in forestry and range management from the University of Montana.

Distinctive SAF Membership Emblem



Button	Tie Chain	Pin
$2.50 ☐	$6.00 ☐	$4.00 ☐

THE EMBLEMS pictured above in actual size are 10K gold, with gold letters on a dark green background surrounded by a gold border. All grades of members are eligible to wear these emblems. Order the style you prefer from:

SOCIETY OF AMERICAN FORESTERS
425 Mills Bldg., 17th St. and Pennsylvania Ave., N. W.
WASHINGTON 6, D. C.

Forester, 24, married, B.S.F. Univ. Maine 1952, M.F. Yale 1953, currently assistant post forester Fort Campbell, Ky.; discharge date September 1955. Experience: land line surveying, mapping, cruising, marking, planting, foreman U.S.F.S. timber stand improvement crew. Specialty—Silviculture, management.
Box E, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, Oregon State, 1951, age 30, veteran, desires field position with private firm in California or Oregon. Four years experience in survey, road location, scaling, cruising, enforcing logging contracts in the redwood and fir region. Excellent references.
Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

NOTICE TO INDUSTRY

Personnel Placement

A service for industrial firms, foresters, and timbermen—to find the best qualified man for the job. List your openings in forestry and allied fields with me. I can supply information on qualified men. Inquiries handled confidentially.

* * *

Foresters send me data on your training and qualifications. Records are confidential. I maintain industry contacts and can advise you on job openings. No fee required unless position is accepted.

Keith Cranston, *Forestry Consultant*
LELAND, MISSISSIPPI

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He has served successively from 1931 to 1950 in the Bureau of Plant Industry in Spokane, Washington, the Bureau of Entomology and Plant Quarantine in Spokane, Washington, and with the Forest Service in Butte, Montana, and Coeur d'Alene, Idaho. He is a veteran of World War II and joined the Bureau of Land Management staff in October 1954.

Allied

E. H. Roche Appointed Editor Forest Products Journal

Appointment of Edward H. Roche, Syracuse, N. Y., as editor of the *Journal of the Forest Products Research Society* has been announced by Frank J. Rovsek, executive secretary, Forest Products Research Society, Madison, Wis.

Roche, former publications editor at the State University of New York College of Forestry at Syracuse, received his A.B. degree in journalism and political science from Syracuse University in January, 1949. He was employed by Roy H. Park, Inc., Ithaca (N. Y.) publishing firm for 1½ years following his graduation. He was editor and production manager of six county Farm Bureau publications until January, 1950, when he was named associate editor of *Co-op Power*, national trade magazine for rural electrification leaders.

Joining the faculty at Syracuse in September, 1950 as publications assistant, Roche was promoted to publications editor in January, 1953.

persistent hoarseness or cough

...is one of the seven commonest danger signals that *may* mean cancer...but should *always* mean a visit to your doctor.

The other six danger signals are —Any sore that does not heal ...A lump or thickening in the breast or elsewhere...Unusual bleeding or discharge...Any change in a wart or mole... Persistent indigestion or difficulty in swallowing...Any change in normal bowel habits.

For other facts about cancer that may some day save your life, phone the American Cancer Society office nearest you, or write to "Cancer"—in care of your local Post Office.

American Cancer Society

Equipment & Products

Weed and Grass Killer

A nonselective weed and grass killer for industrial, agricultural, and railroad use has been announced by Chipman Chemical Company, Inc., Bound Brook, N. J. This new product "Chlorea" kills all types of vegetation. It is a uniform, nonseparating combination of sodium chlorate, borate, and CMU . . . combining the proved effectiveness of chlorate on deep-rooted weeds with the prolonged soil-surface action of CMU on shallow-rooted grasses and annual seedling growth. It also has a lasting residual effect to inhibit regrowth. Chlorea is nonpoisonous and, because of its borate content, does not create a fire hazard when used as directed. It can be applied dry or used as a water-mixed spray. Further information and literature may be obtained from the manufacturer.

New Clearing Attachment

The Homelite Corporation, 48 Riverdale Avenue, Port Chester, N. Y., announces a new, low-cost attachment that converts the Homelite Model 17 Chain Saw into an all-purpose clearing unit. Simple to operate this new clearing attachment permits one man to do the work of a whole gang of men using saws and axes.

Designed for faster, easier, more profitable clearing, the new attachment eliminates stoop and squat in felling; lets you reach out to the limb without having to go underneath; takes the backache out of bucking and underbucking. Jaw-grip spike permits plunge-bucking of logs right on the ground. Spike bites into the dirt, keeps chain up out of the dirt; spike takes thrust of the chain, prevents logs from rolling or spinning away.

According to the company's field reports, "On job after job, records prove that one man with this Homelite attachment keeps three men busy clearing up limbs and piling brush. In most cases," the company states, "you can save enough money on the very first day to pay for the attachment!"

CATERPILLAR ANNOUNCES THE NEW D7 SERIES C

MORE POWER
SMOOTHER PERFORMANCE

NOW 102 DRAWBAR HP! NOW A VIBRATION BALANCER ON THE ENGINE!

Here's the new CAT Diesel D7 Tractor . . . latest example of Caterpillar Leadership in Action!*

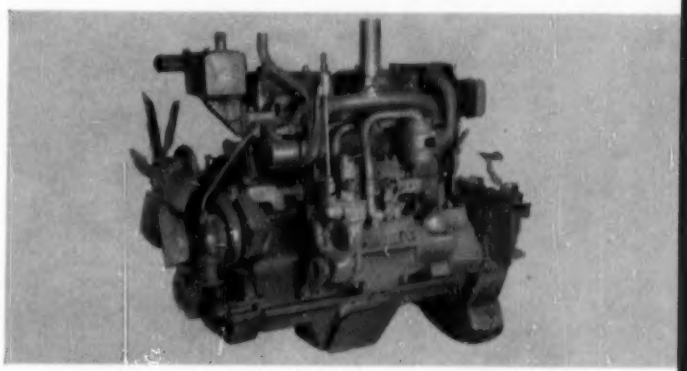
Drawbar HP increased to 102, engine HP to 128 (at 1200 r.p.m.).

Vibration balancer on the 4-cylinder engine now gives all the smoothness of 6-cylinder performance.

Drawbar pull now 28,700 pounds maximum.

New starting engine has more power for surer, faster starts in all weather, and simple single-lever control for easier operation.

New "water quench" process for hardening track shoes almost doubles shoe life.



NEW 128-HP ENGINE features improved fuel injection system, flanged center main bearing to take crankshaft thrust, many other advances.

The new D7 Series C is ready now to give you more profitable production than ever before. Call your Caterpillar Dealer today for a demonstration!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

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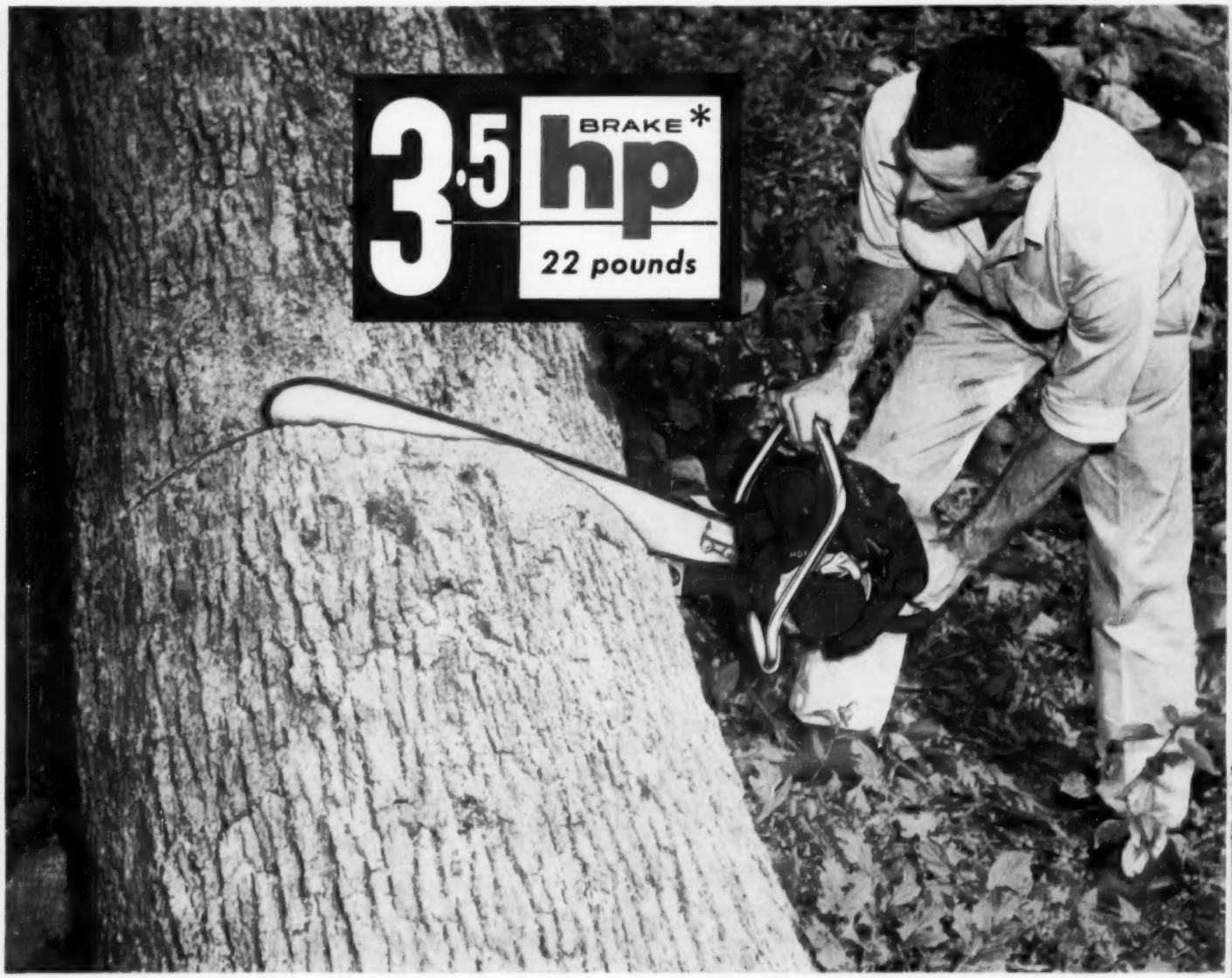
BIG STUFF
IS EASY STUFF

True, it weighs in at only 22 pounds. But when it comes to production, a Homelite Model 17 will outcut many chain saws in the heavy weight class. It brings down big, hardwood trees . . . 4 feet or more in diameter . . . quickly and easily. It cuts 18 inch trees in as little as 18 seconds. And, *of great importance,* it stands up under the grind.

WITH A HOMELITE MODEL 17



You can be sure of this! Every time you buy a Homelite Chain Saw, you get a real production saw. It might cost a bit more to buy, but professional woodcutters have found that this initial cost of premium quality is soon written off by *increased production* and *decreased maintenance.* Built and backed by engineers who have specialized in lightweight gasoline-engine-driven units for nearly half a century, a Homelite gives you everything you need in a saw . . . more dependability, easier handling on every type of cut, and more power per pound than any other saw. Write for free demonstration.

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